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(54) **PLASTICIZER AND PLASTIC PRODUCT**

(71) Applicant: **LARGAN MEDICAL CO., LTD.**,
Taichung (TW)

(72) Inventors: **Wei-Yuan Chen**, Taichung (TW);
Tzu-Rong Lu, Taichung (TW); **Yi-Ling**
Chen, Taichung (TW); **Chun-Hung**
Teng, Taichung (TW)

(73) Assignee: **LARGAN MEDICAL CO., LTD.**,
Taichung (TW)

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C08K 5/00 (2006.01)
C08K 5/06 (2006.01)
C08K 5/101 (2006.01)
C08K 5/17 (2006.01)
C08L 33/06 (2006.01)

(52) **U.S. Cl.**

CPC **C08K 5/0016** (2013.01); **C08K 5/175**
(2013.01); **C08L 33/06** (2013.01)

(58) **Field of Classification Search**

CPC C08K 5/0016; C08K 5/175; C08K 5/20;
C08K 5/06; C08K 5/101
See application file for complete search history.

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Primary Examiner — Karuna P Reddy
(74) *Attorney, Agent, or Firm* — McClure, Qualey &
Rodack, LLP

(57) **ABSTRACT**

A plasticizer, which is biodegradable, has a molecule includ-
ing a central structure, at least two connecting structures and
at least one side-chain structure. The central structure
includes at least one of a benzene derivative and at least one
amino acid. The connecting structures are respectively con-
nected to the central structure, wherein the connecting
structures include a first connecting structure and a second
connecting structure. The first connecting structure is an
amine group, and the second connecting structure is a
carboxyl group. The side-chain structure is a chain of
multiple carbon atoms, and the side-chain structure is con-
nected to at least one of the first connecting structure and the
second connecting structure. An amide bond is formed as the
side-chain structure connected to the amine group, and an
ester bond is formed as the side-chain structure connected to
the carboxyl group.

11 Claims, 15 Drawing Sheets

100

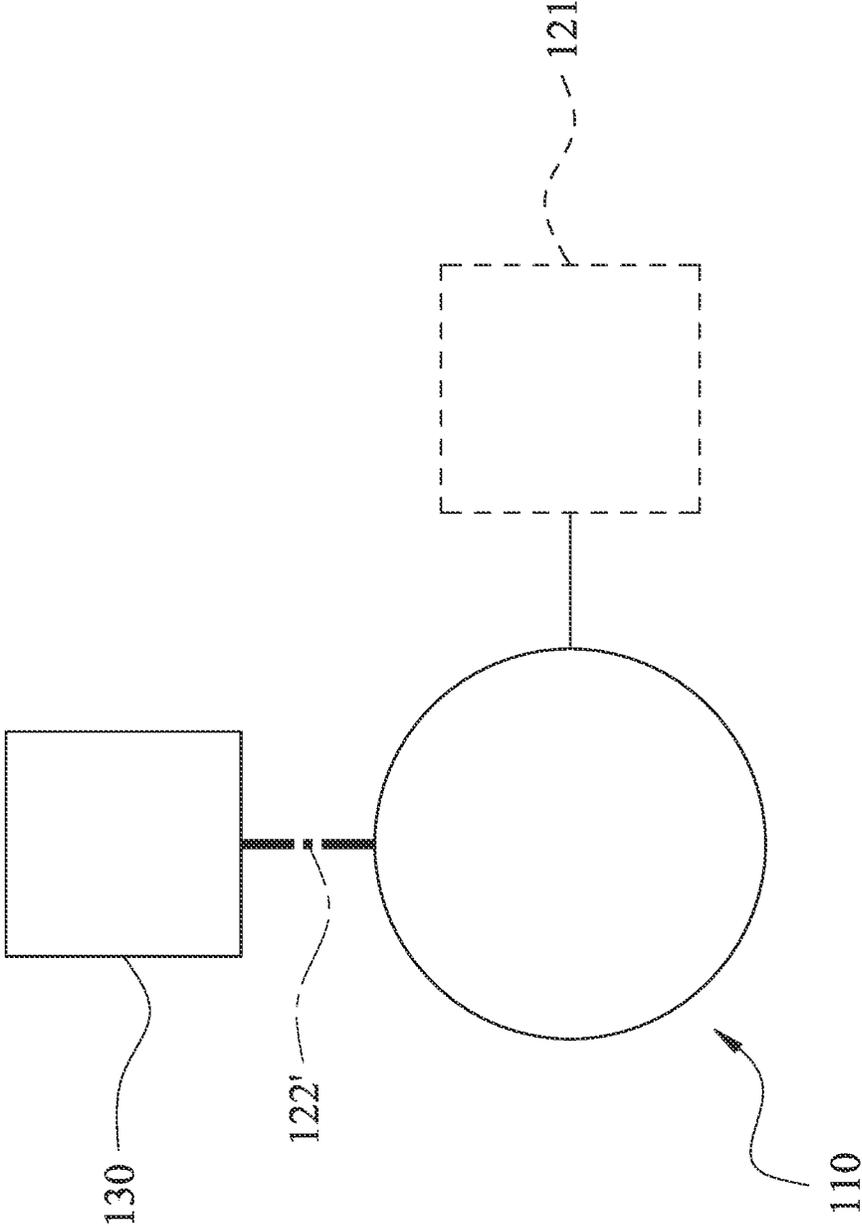


Fig. 1

200

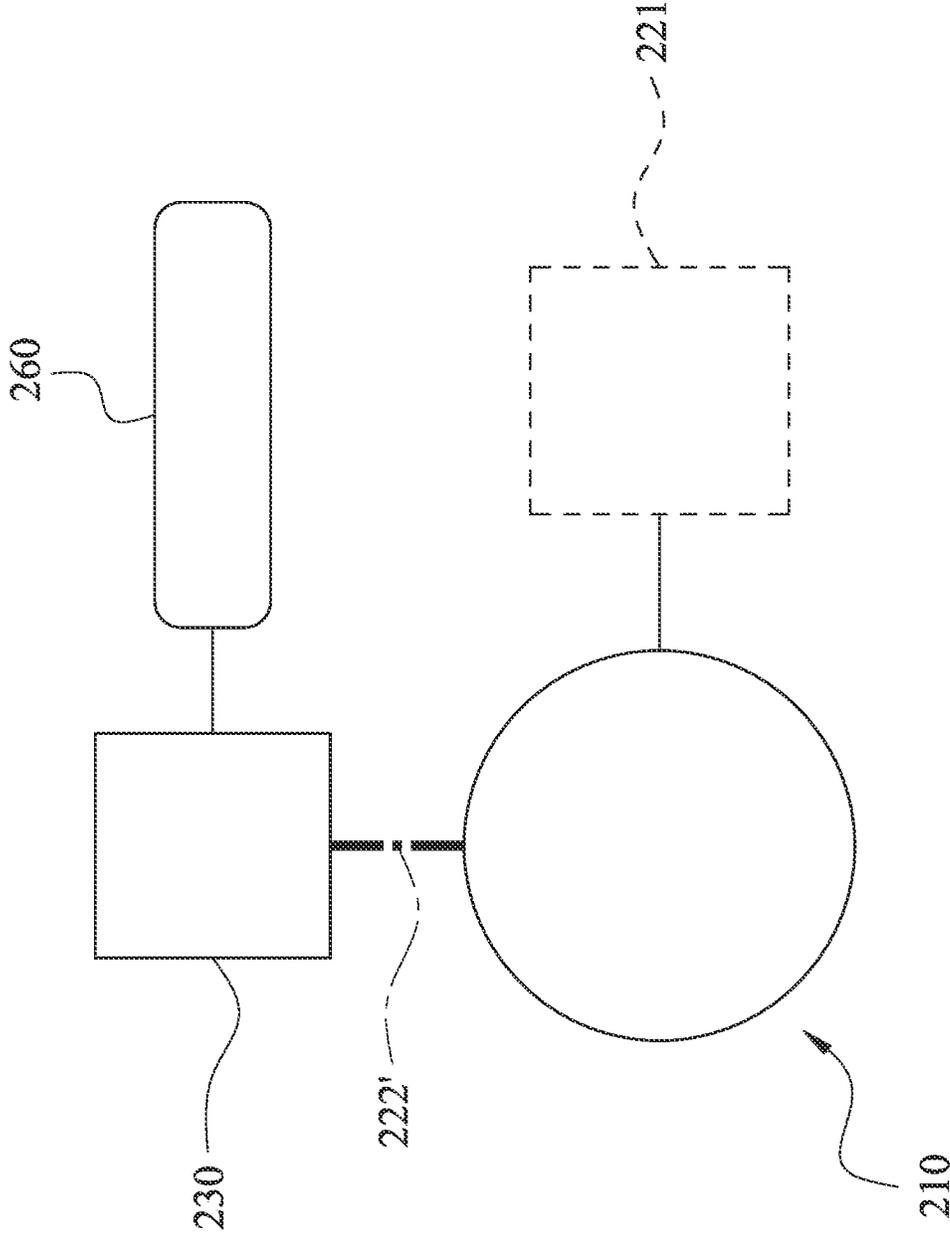


Fig. 2

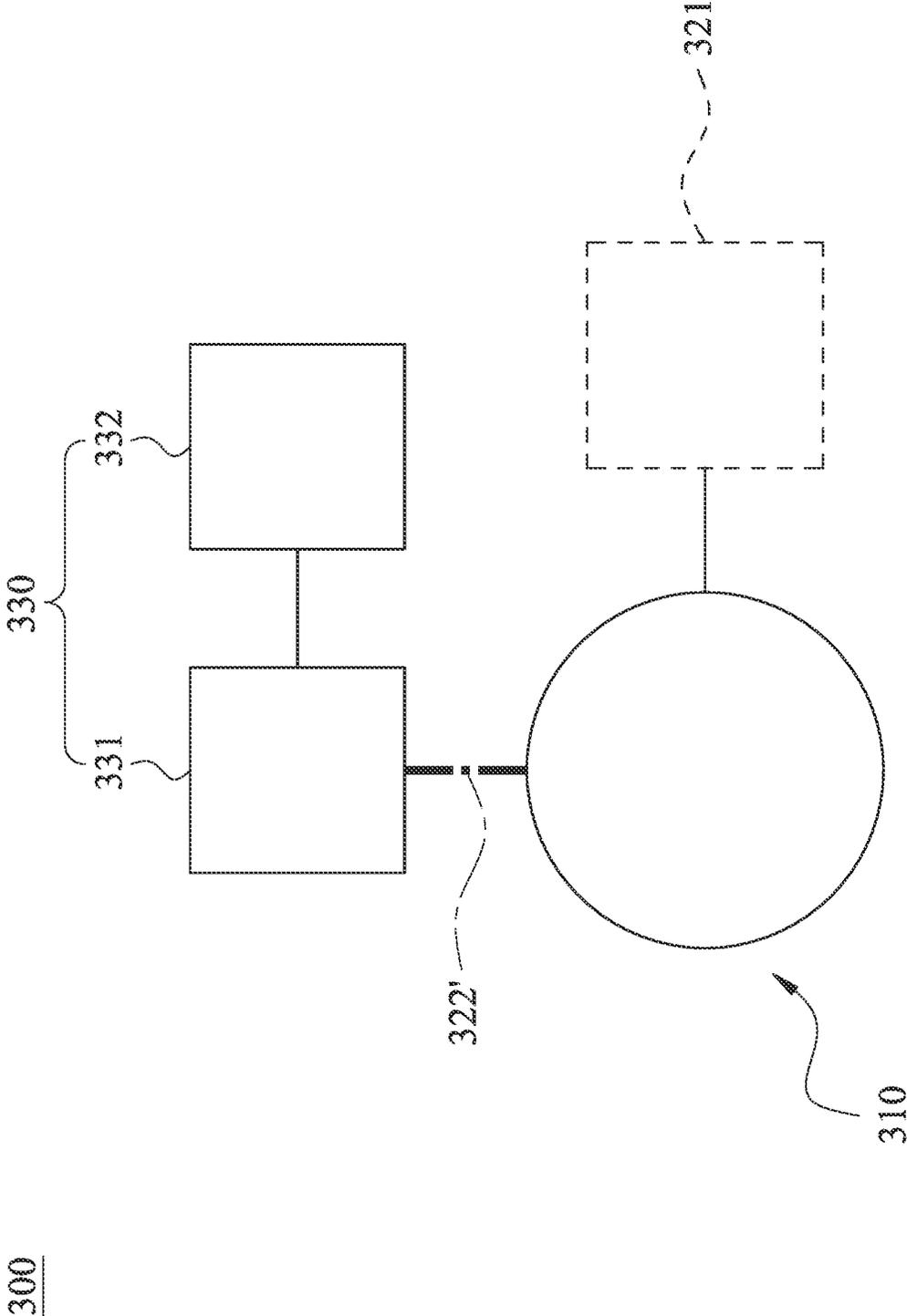


Fig. 3

400

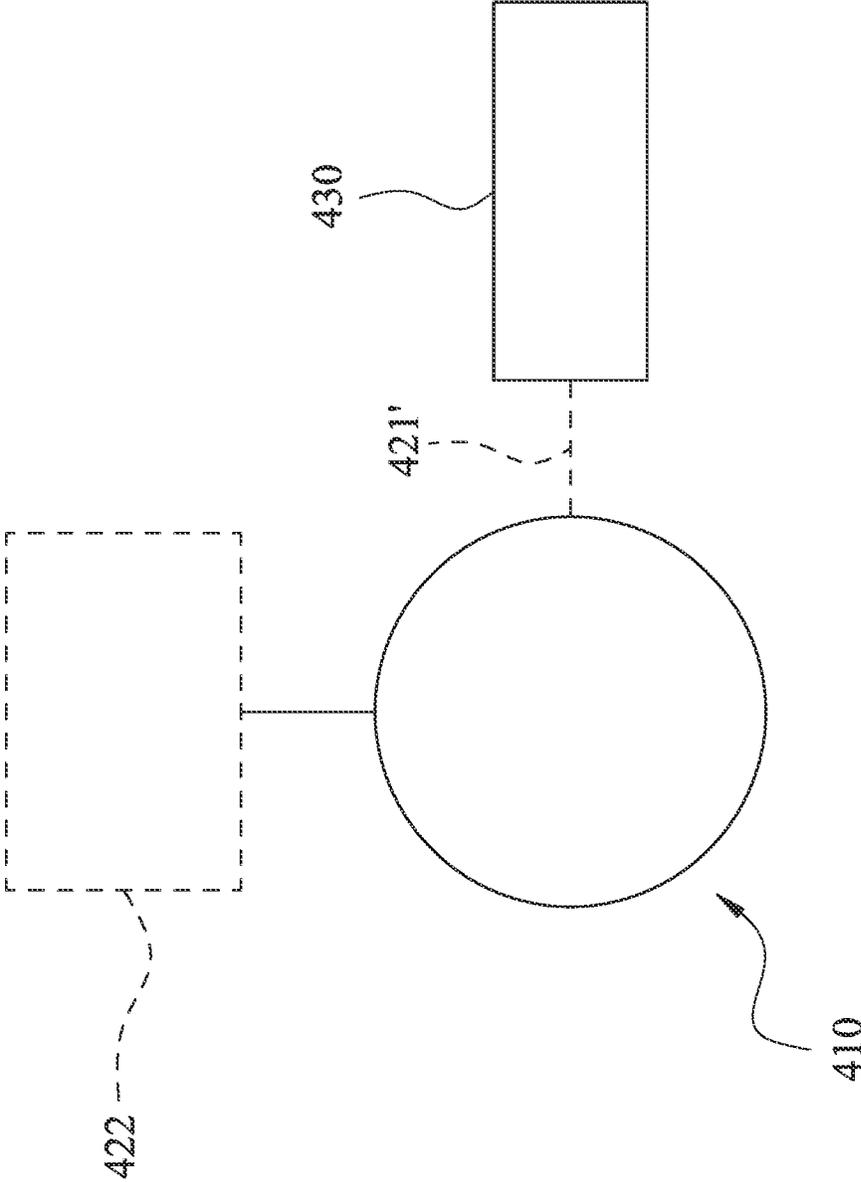


Fig. 4

500

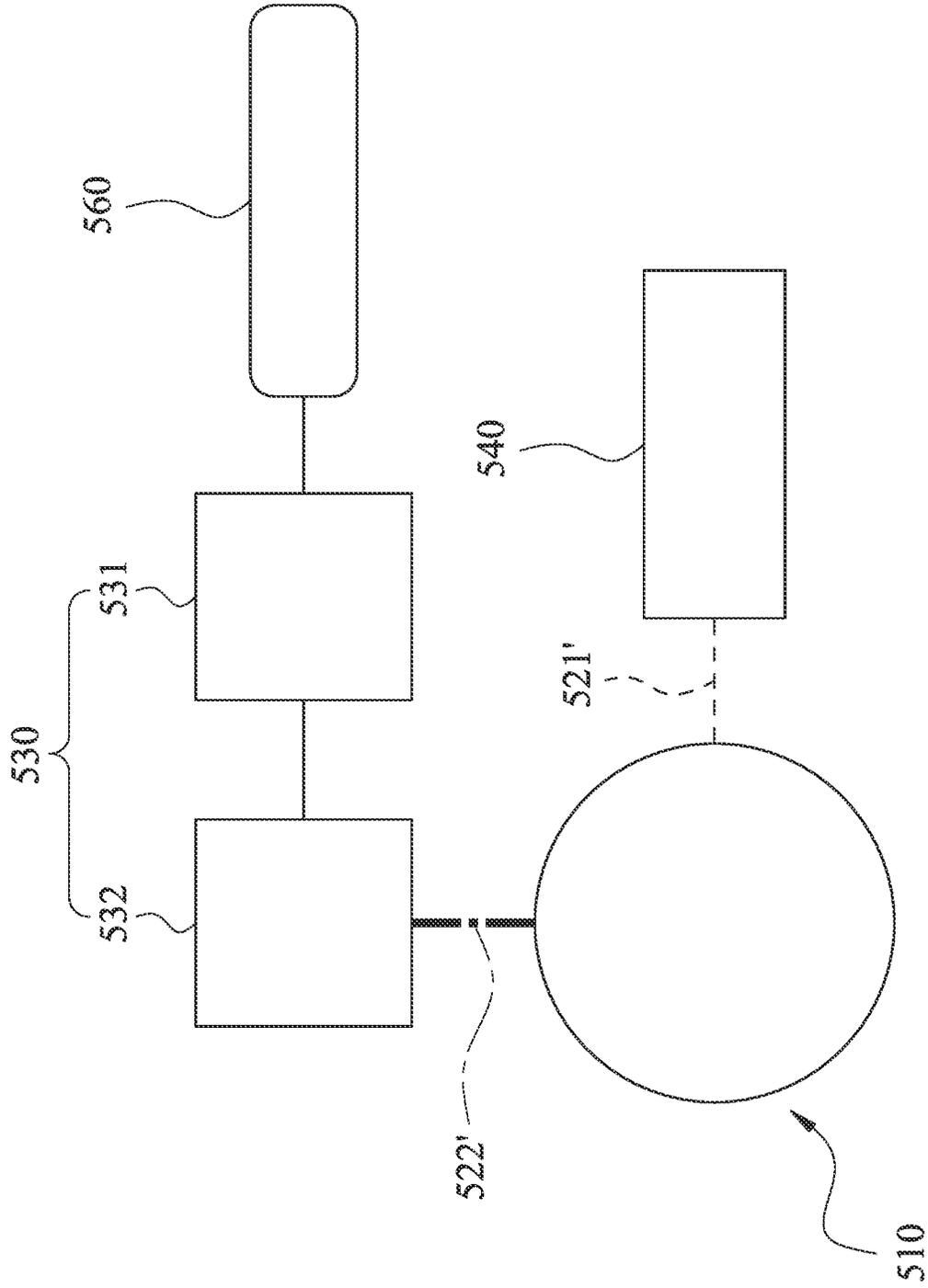


Fig. 5

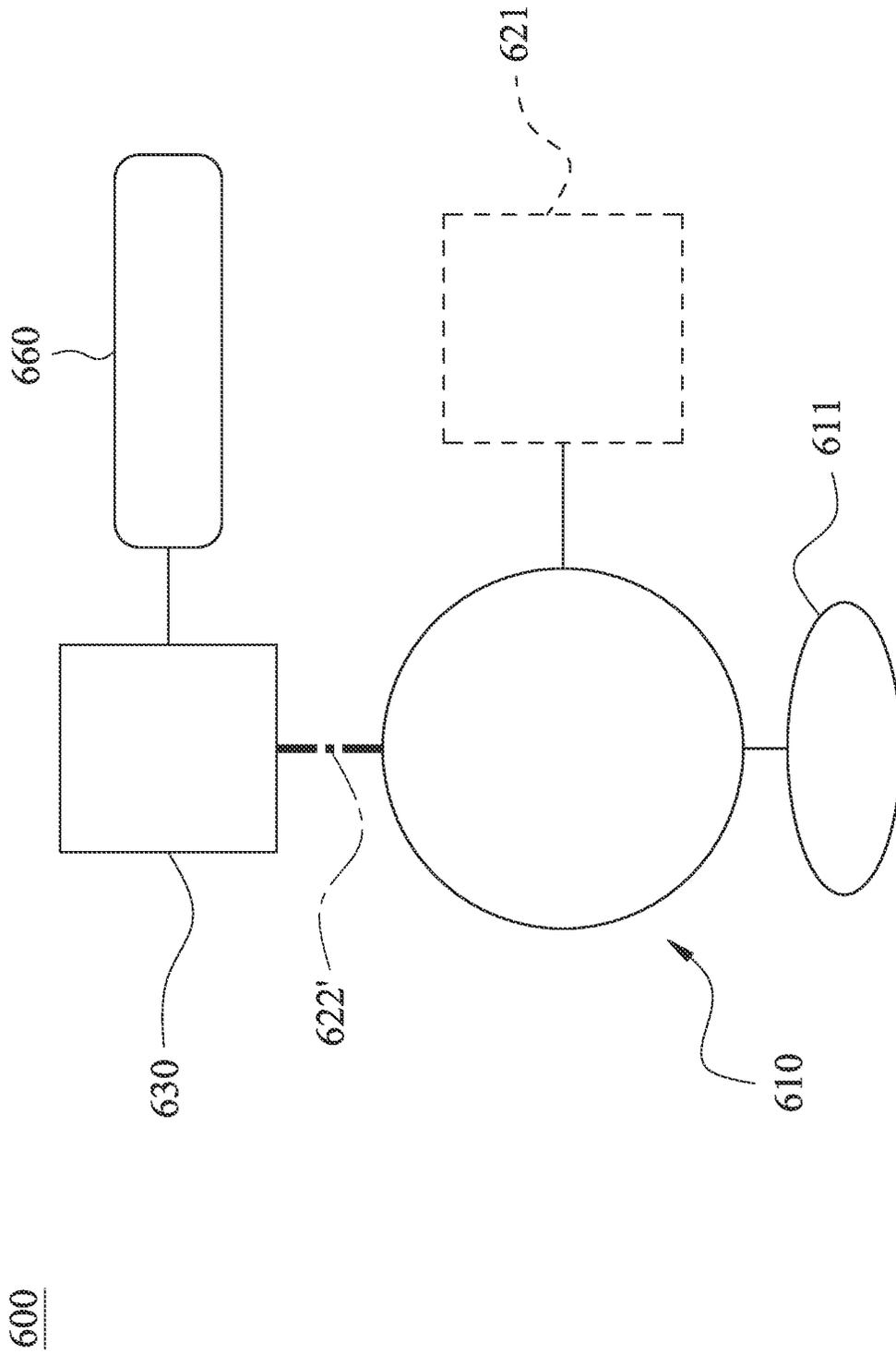


Fig. 6

700

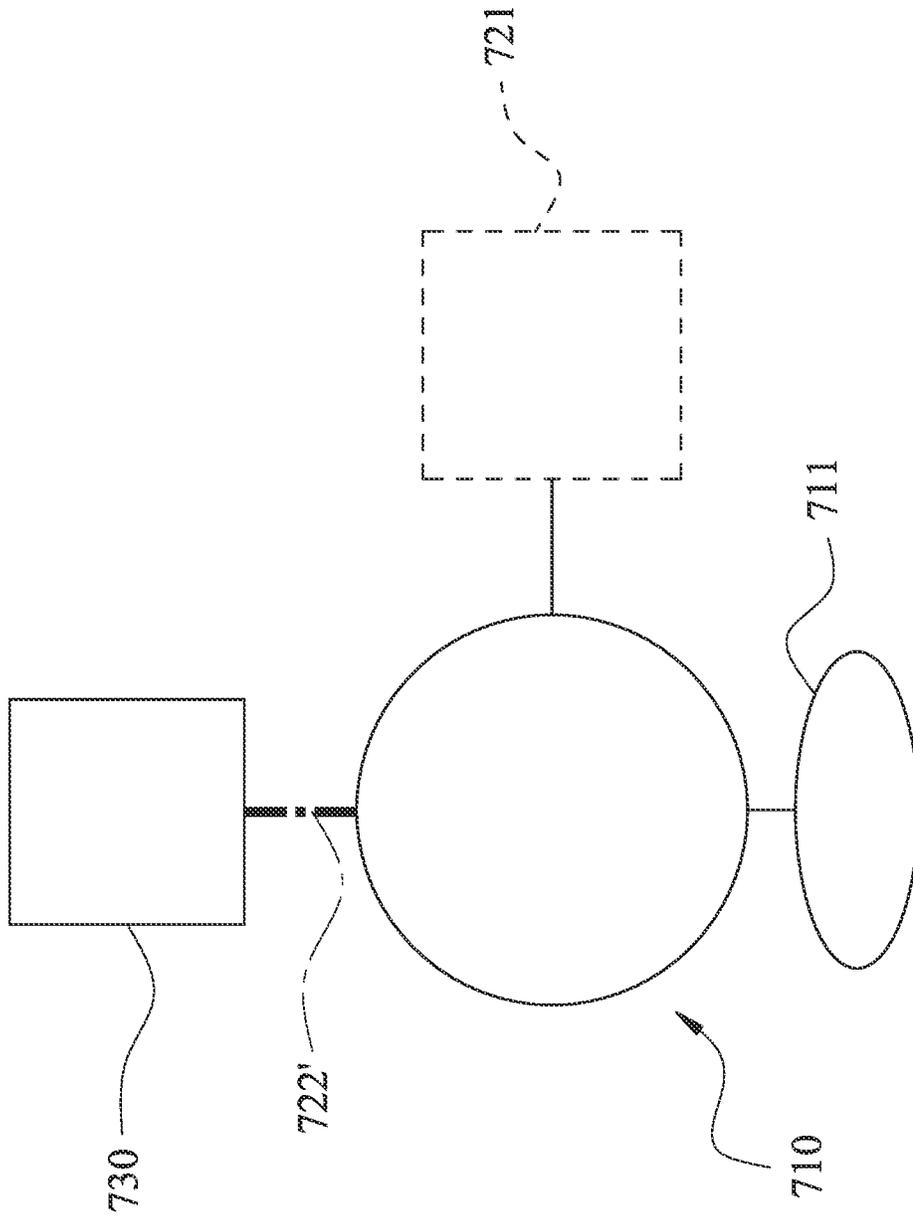


Fig. 7

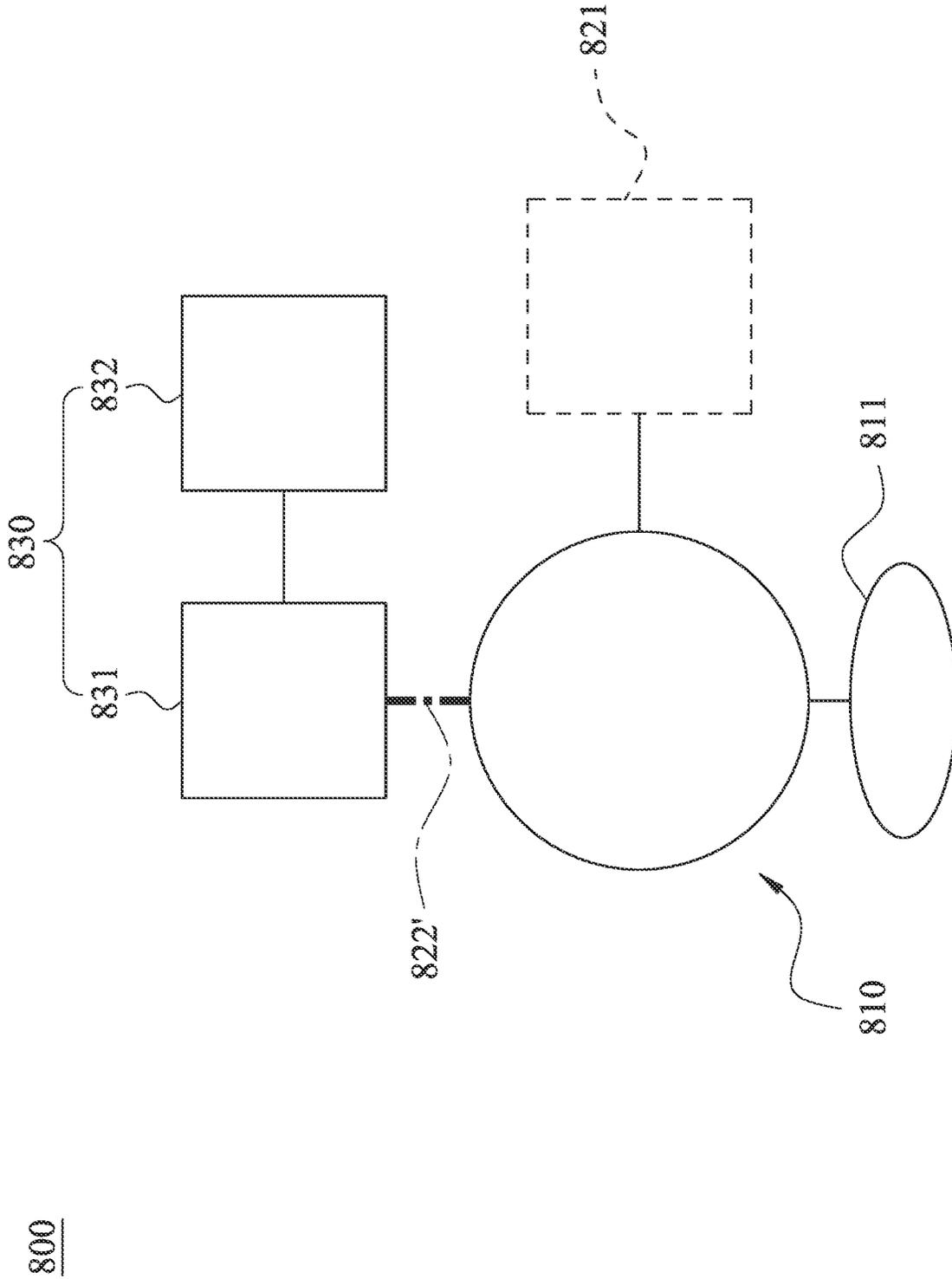


Fig. 8

900

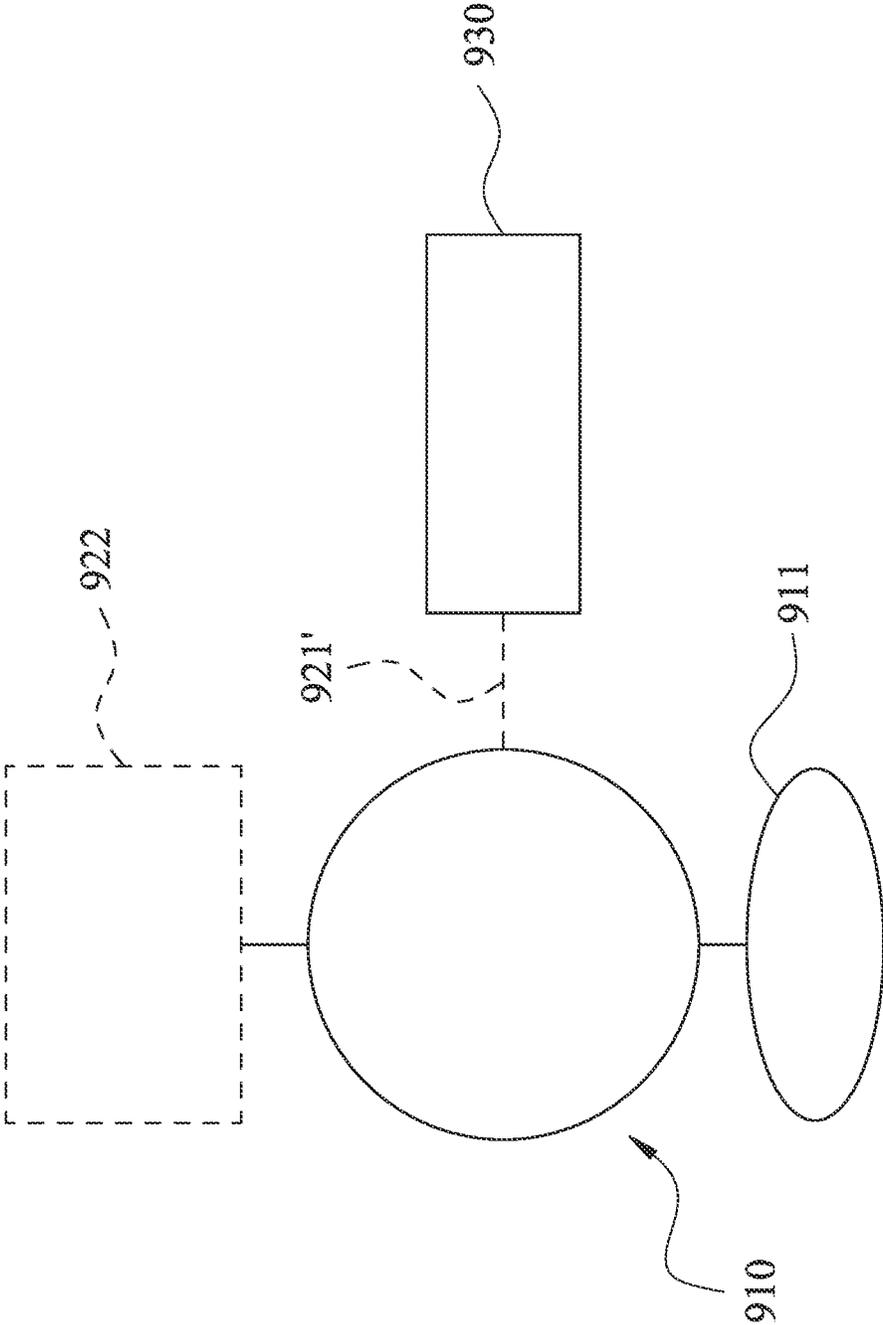


Fig. 9

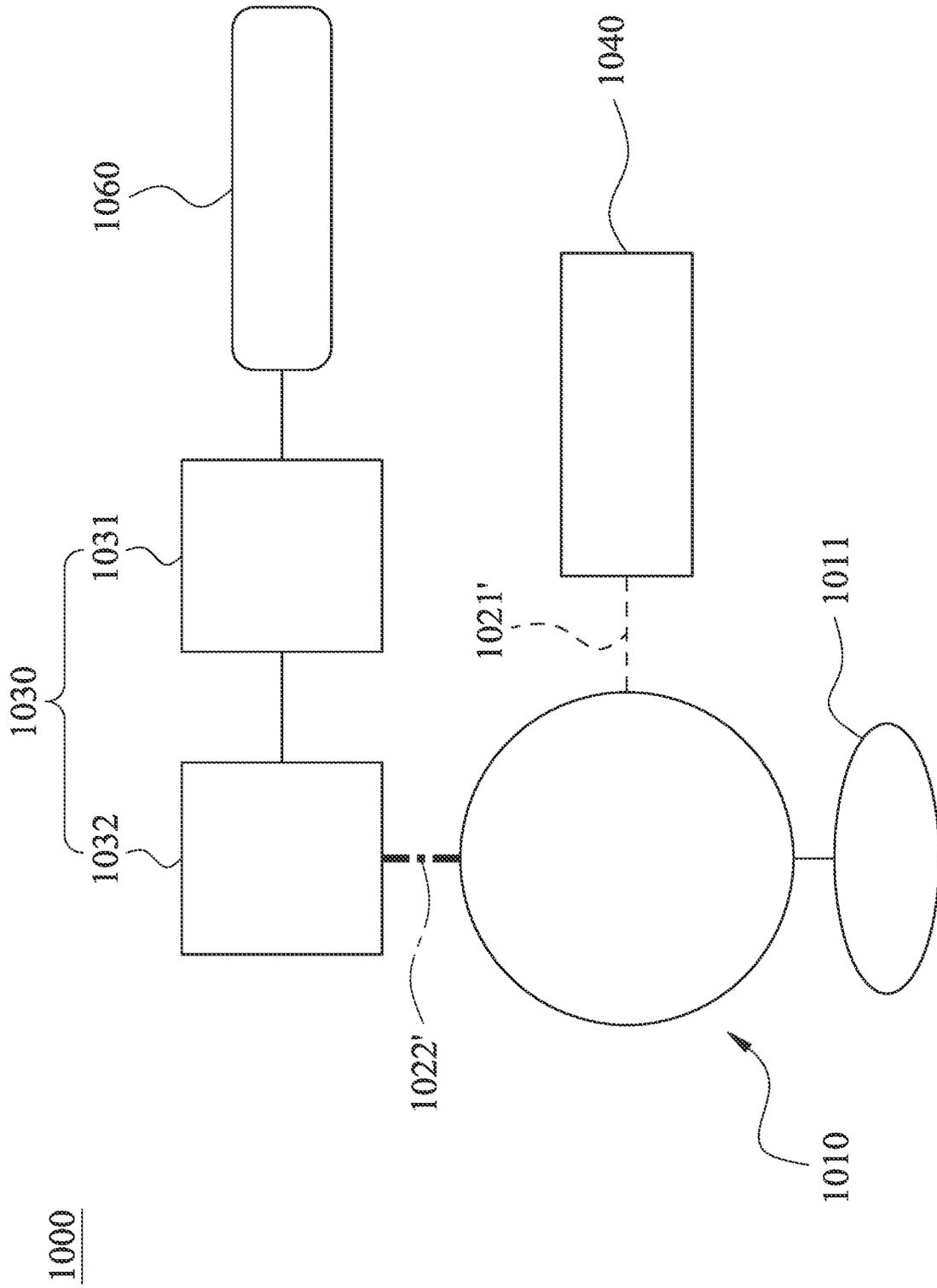


Fig. 10

1100

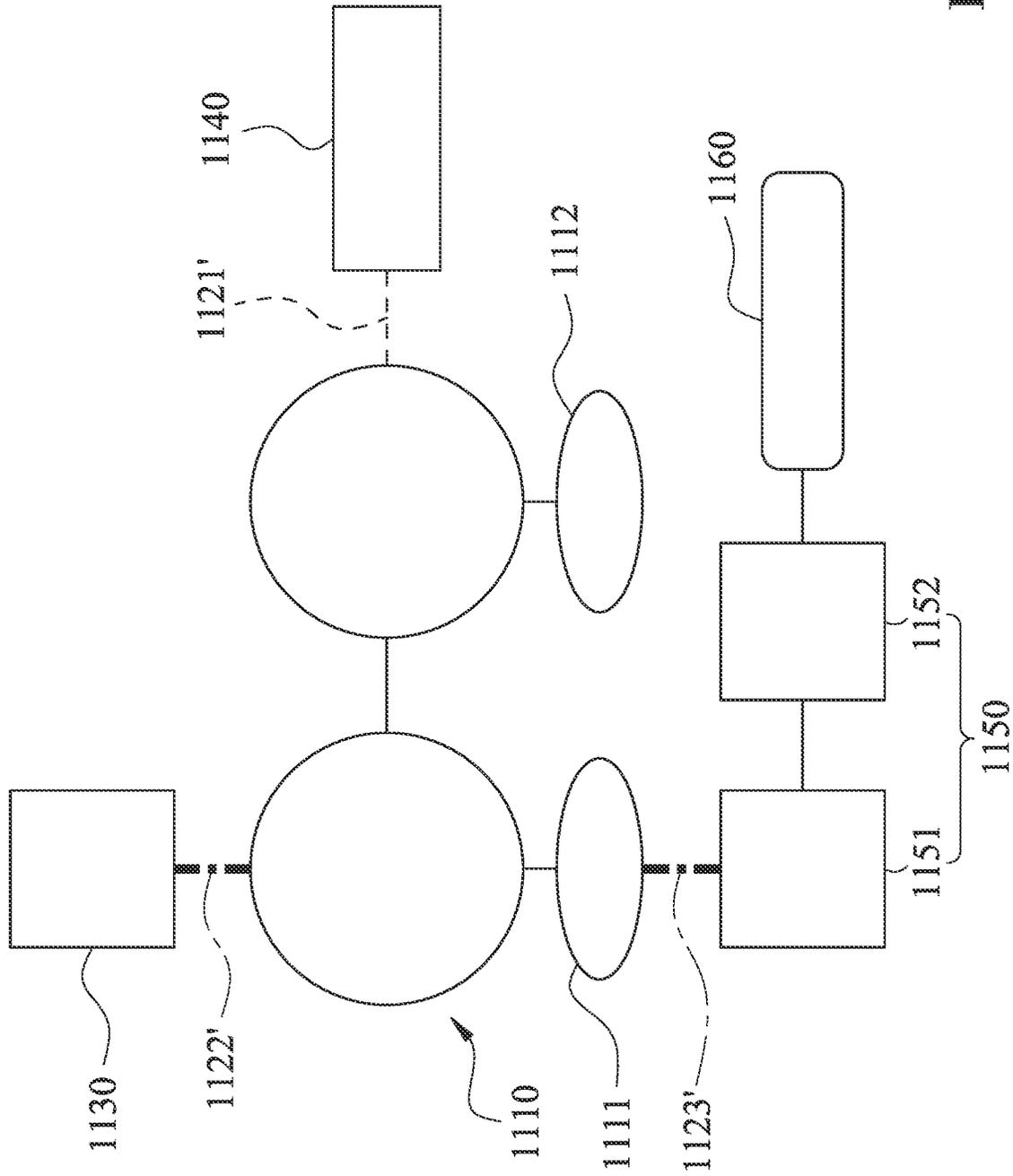


Fig. 11

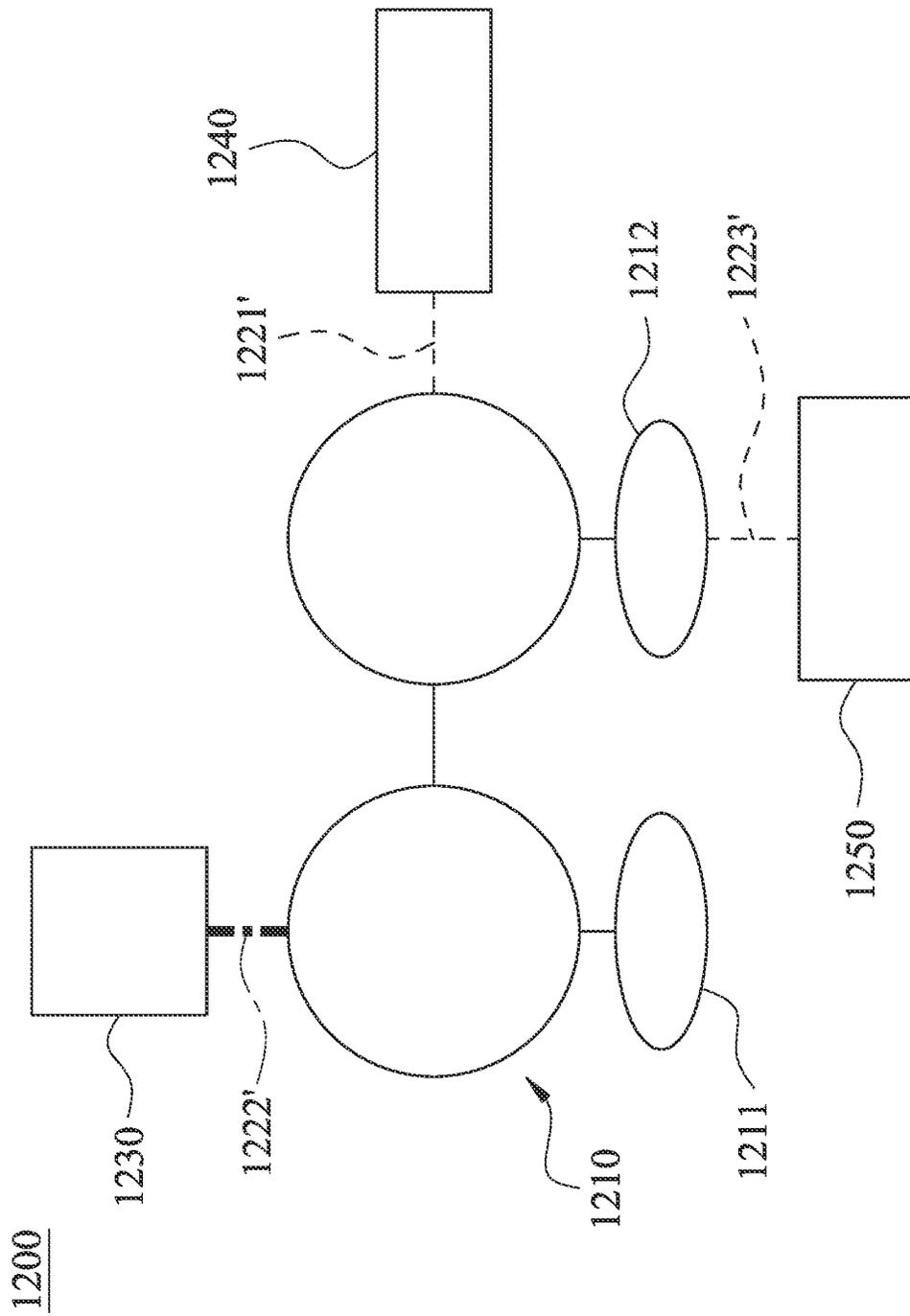


Fig. 12

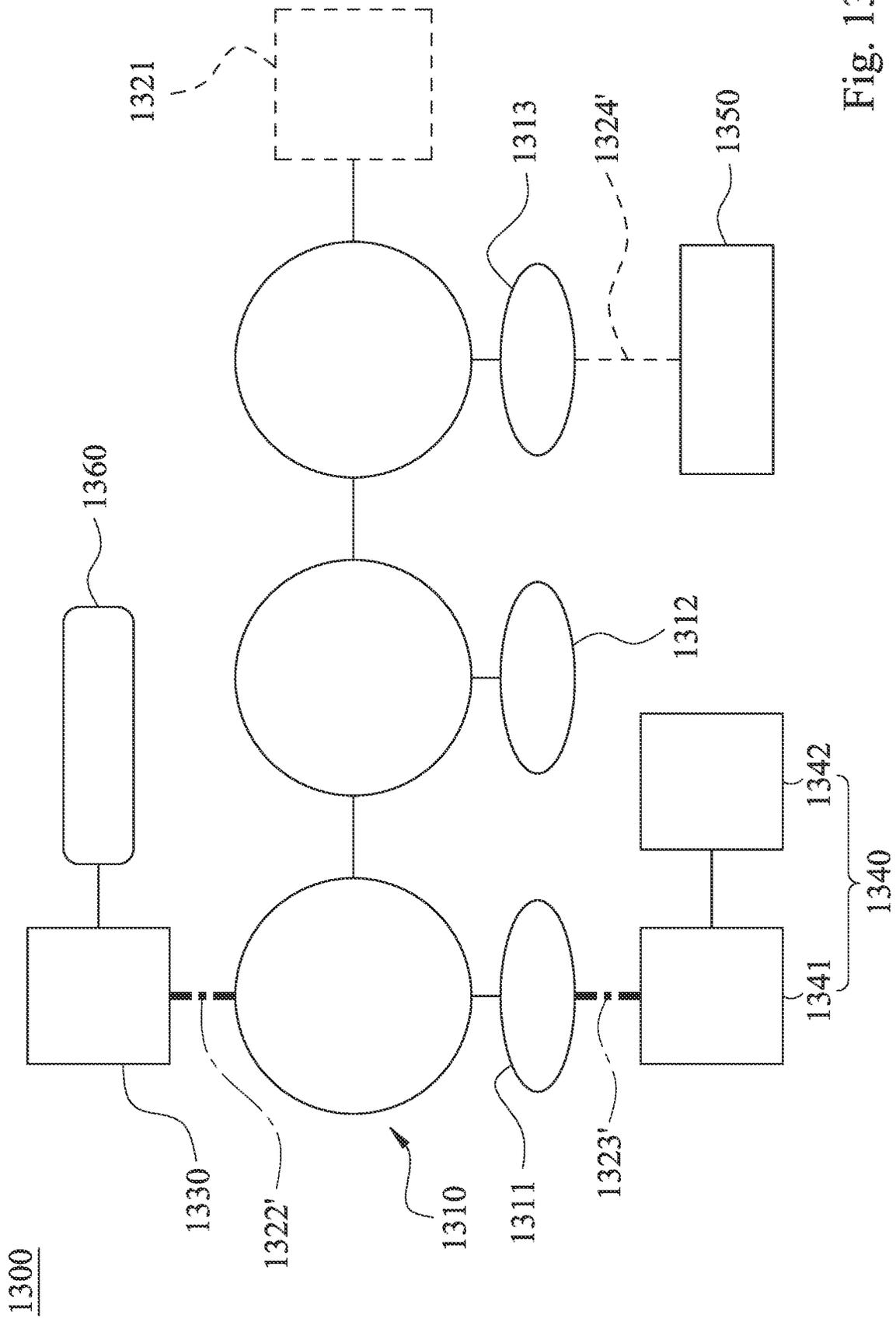


Fig. 13

1400

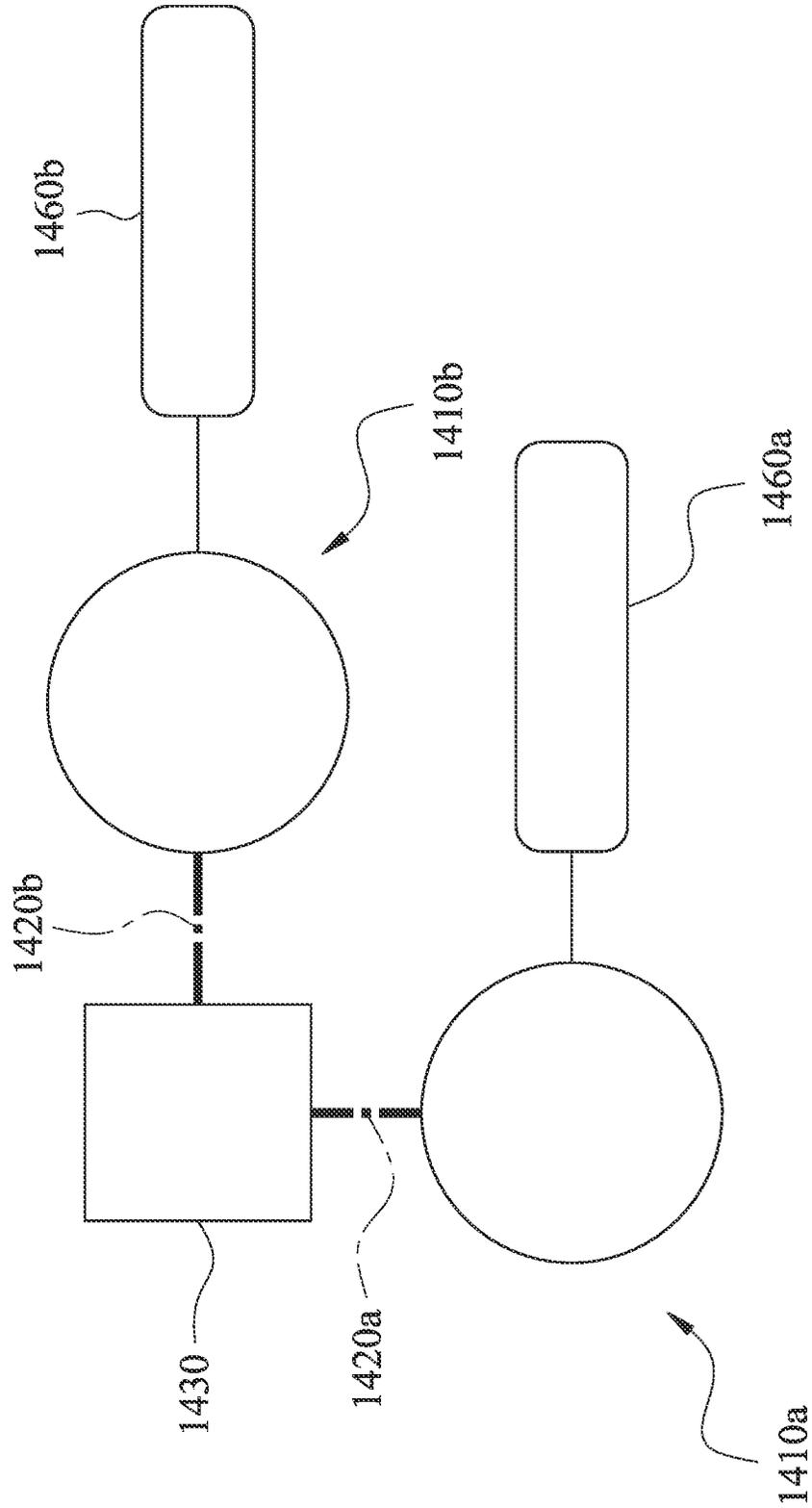


Fig. 14

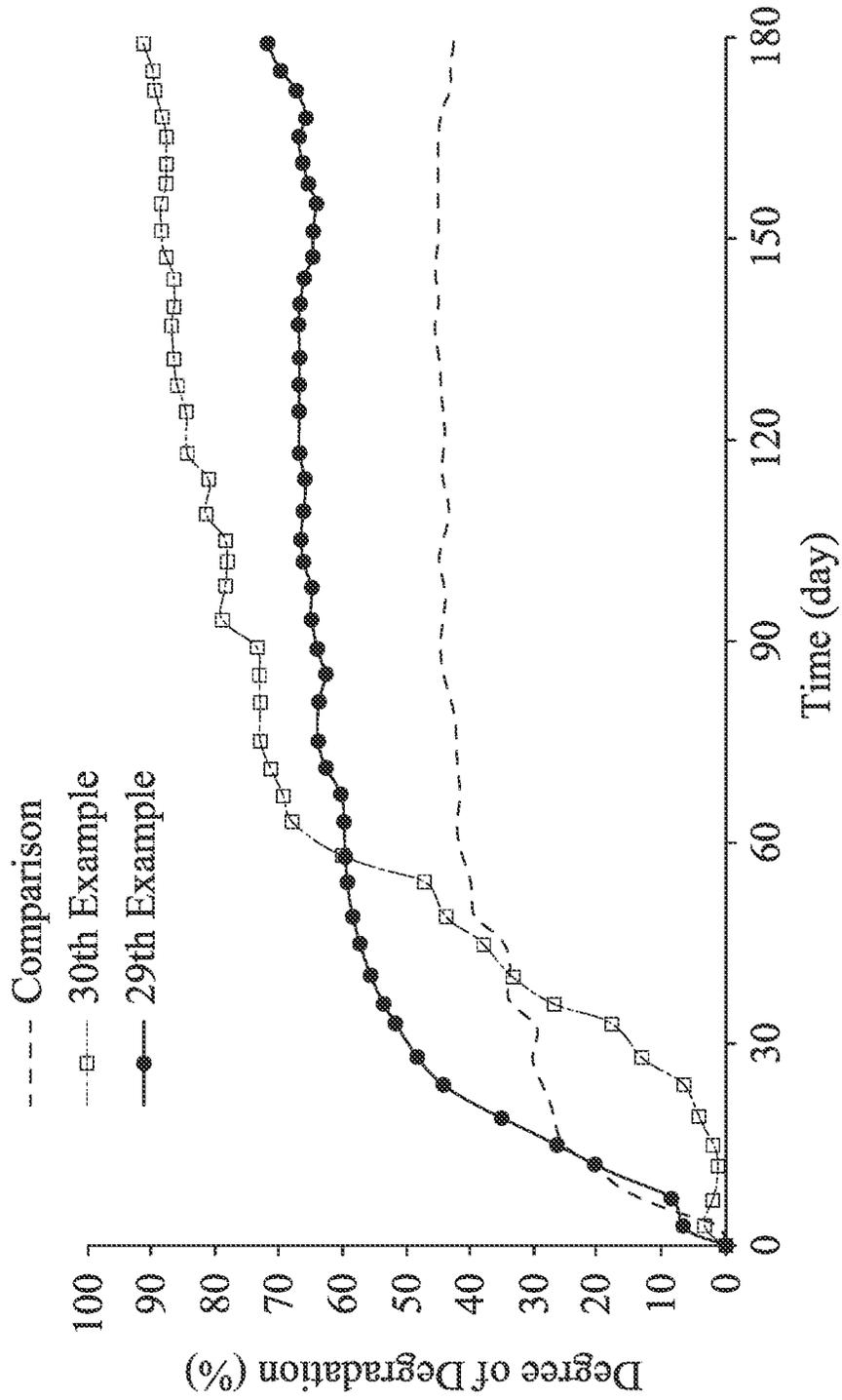


Fig. 15

PLASTICIZER AND PLASTIC PRODUCT

RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 62/939,733, filed Nov. 25, 2019, which is herein incorporated by reference.

BACKGROUND

Technical Field

The present disclosure relates to an additive for plastic materials. More particularly, the present disclosure relates to a biodegradable plasticizer.

Description of Related Art

In order to solve the environmental problems brought on by plastic products, biodegradable plastics, such as polylactic acid (PLA), poly(butylene succinate) (PBS) and poly(butylene adipate-co-terephthalate) (PBAT), have already been developed. However, properties of this type of plastics are still not as good as petroleum-based plastics. For example, polylactic acid has excellent rigidity and high transparency, but lacks enough durability, heat resistance, impact resistance, flexibility and airtightness, which limits the applications of polylactic acid.

To deal with problems in properties, textures and costs of biodegradable plastics, conventional biodegradable additives can be added to change the flexibility and durability of biodegradable plastics. However, the enhancement of biodegradation in properties of biodegradable plastics made by adding conventional additives is still insufficient. Also, the conventional additives are likely to release and have higher cost, so there has a lot of improvements for the conventional additives. Furthermore, the conditions for degradation of biodegradable plastics are tough. For example, plastic products made of polylactic acid can completely degrade into carbon dioxide and water only under particular environmental conditions for a sufficient time, and then enter the cycle without harming the natural environment. However, it is pretty difficult for plastic products of polylactic acid naturally and completely degrading in a typical environment. In this regard, the important trend for future is to develop an additive, which can enhance the degradation rate to facilitate biodegradable plastics quickly degrading and entering the natural environment.

SUMMARY

According to one aspect of the present disclosure, a plasticizer, which is biodegradable, has a molecule including a central structure, at least two connecting structures and at least one side-chain structure. The central structure includes at least one of a benzene derivative and at least one amino acid. The at least two connecting structures are respectively connected to the central structure, wherein the at least two connecting structures include a first connecting structure and a second connecting structure. The first connecting structure is an amine group, and the second connecting structure is a carboxyl group. The at least one side-chain structure is a chain of multiple carbon atoms, and the at least one side-chain structure is connected to at least one of the first connecting structure and the second connecting structure. An amide bond is formed as the at least one side-chain structure connected to the amine group, and an ester bond is

formed as the at least one side-chain structure connected to the carboxyl group. When a number of carbon atoms of the side-chain structure which is connected to the amine group is n_{NC} , and a number of carbon atoms of the side-chain structure which is connected to the carboxyl group is n_{OC} , the following condition is satisfied: $0 \leq n_{NC}/(n_{NC}+n_{OC}) \leq 1.00$, wherein each of n_{NC} and n_{OC} is 0 or positive integer, but n_{NC} and n_{OC} are not 0 at the same time.

According to another aspect of the present disclosure, a plastic product, which is biodegradable, includes the plasticizer of the aforementioned aspect and a polyester plastic, wherein the polyester plastic is a polylactic acid, a polybutylene succinate, a poly(butylene adipate-co-terephthalate) or a polyhydroxyalkanoate, and the plasticizer is mixed with the polyester plastic.

According to another aspect of the present disclosure, a plasticizer, which is biodegradable, has a molecule including at least two central structures, at least two connecting structures and a side-chain structure. Each of the central structures includes at least one of a benzene derivative and at least one amino acid. Each of the connecting structures is a carboxyl group, and each of the central structures is connected to at least one of the connecting structures. The side-chain structure is a chain of multiple carbon atoms, each of the central structures is connected to the side-chain structure through the connecting structures, and an ester bond is formed as the side-chain structure connected to each of the carboxyl groups.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:

FIG. 1 is a structural schematic view of a molecule of a plasticizer according to the 1st embodiment of the present disclosure.

FIG. 2 is a structural schematic view of a molecule of a plasticizer according to the 2nd embodiment of the present disclosure.

FIG. 3 is a structural schematic view of a molecule of a plasticizer according to the 3rd embodiment of the present disclosure.

FIG. 4 is a structural schematic view of a molecule of a plasticizer according to the 4th embodiment of the present disclosure.

FIG. 5 is a structural schematic view of a molecule of a plasticizer according to the 5th embodiment of the present disclosure.

FIG. 6 is a structural schematic view of a molecule of a plasticizer according to the 6th embodiment of the present disclosure.

FIG. 7 is a structural schematic view of a molecule of a plasticizer according to the 7th embodiment of the present disclosure.

FIG. 8 is a structural schematic view of a molecule of a plasticizer according to the 8th embodiment of the present disclosure.

FIG. 9 is a structural schematic view of a molecule of a plasticizer according to the 9th embodiment of the present disclosure.

FIG. 10 is a structural schematic view of a molecule of a plasticizer according to the 10th embodiment of the present disclosure.

FIG. 11 is a structural schematic view of a molecule of a plasticizer according to the 11th embodiment of the present disclosure.

FIG. 12 is a structural schematic view of a molecule of a plasticizer according to the 12th embodiment of the present disclosure.

FIG. 13 is a structural schematic view of a molecule of a plasticizer according to the 13th embodiment of the present disclosure.

FIG. 14 is a structural schematic view of a molecule of a plasticizer according to the 14th embodiment of the present disclosure.

FIG. 15 shows results of biodegradation tests of the comparison, the 29th Example and the 30th Example.

DETAILED DESCRIPTION

A plasticizer, which is biodegradable, has a molecule including a central structure, at least two connecting structures and at least one side-chain structure. The at least two connecting structures are respectively connected to the central structure, and the side-chain structure is connected to at least one of the at least two connecting structures.

The central structure includes at least one of a benzene derivative and at least one amino acid. It is favorable for maintaining the biodegradability of the plasticizer by having the benzene derivative. The amino acid can be degraded and metabolized in animal cells, so that it is favorable for enhancing the biodegradability of the plasticizer. Moreover, the central structure can be the benzene derivative, and can further include the amino acid. Furthermore, the central structure can be the amino acid, and can include at least two of the amino acid. The residue of the amino acid can be acidic, basic, hydrophilic or hydrophobic, so that it is favorable for adjusting the properties of the plasticizer according to the residue characteristics of the amino acid.

The benzene derivative can be compounds with similar structures, such as 2-aminobenzoic acid, 3-aminobenzoic acid, 4-aminobenzoic acid, 2-hydroxybenzoic acid, 3-hydroxybenzoic acid or 4-hydroxybenzoic acid.

The amino acid can be standard amino acids, essential amino acids which humans cannot synthesize, modified amino acids (such as hydroxyproline, hydroxylysine or thyroxine) or other non-standard amino acids (such as homocysteine, homoserine or ornithine). The standard amino acids and essential amino acids are listed in Table 1 below.

TABLE 1

Standard Amino Acids and Essential Amino Acids		
Amino Acid	Abbreviation	Essential Amino Acid
Alanine	Ala	No
Arginine	Arg	No
Asparagine	Asn	No
Aspartate	Asp	No
Cysteine	Cys	No
Glutamate	Glu	No
Glutamine	Gln	No
Glycine	Gly	No
Histidine	His	Yes
Isoleucine	Ile	Yes
Leucine	Leu	Yes
Lysine	Lys	Yes
Methionine	Met	Yes
Phenylalanine	Phe	Yes
Proline	Pro	No
Pyrrolysine	Pyl	No

TABLE 1-continued

Standard Amino Acids and Essential Amino Acids		
Amino Acid	Abbreviation	Essential Amino Acid
Selenocysteine	Sec	No
Serine	Ser	No
Threonine	Thr	Yes
Tryptophan	Trp	Yes
Tyrosine	Tyr	No
Valine	Val	Yes

The central structure can also be glycerol (propane-1,2,3-triol) or 2-(2-hydroxyethoxy)propan-1-ol.

The at least two connecting structures include a first connecting structure and a second connecting structure. The first connecting structure is an amine group, and the second connecting structure is a carboxyl group.

If the central structure is the benzene derivative, the position of the amine group and the position of the carboxyl group can be adjacent to each other (ortho) or not adjacent (meta or para) on the benzene derivative.

The amine group can be a functional group of —NH_2 , —NHR , or —NR_2 . Moreover, the amine group can be a primary amine, a secondary amine, a tertiary amine or a quaternary ammonium cation. Furthermore, a hydroxyl group can be substituted for the amine group of the first connecting structure. When the side-chain structure is connected to the hydroxyl group, the connection therebetween can be split through hydrolysis reaction, so that it is favorable for enhancing the biodegradability of the plasticizer.

When the molecule of the plasticizer includes two connecting structures, the two connecting structures are respectively the first connecting structure and the second connecting structure. Moreover, the molecule of the plasticizer can include three connecting structures, which are respectively the first connecting structure, the second connecting structure and a third connecting structure. The third connecting structure can be the residue of the amino acid. For example, the amine group of the residue from lysine can be taken as the third connecting structure, or the carboxyl group of the residue from aspartate can be taken as the third connecting structure. Further, the molecule of the plasticizer can include four connecting structures, which are respectively the first connecting structure, the second connecting structure, the third connecting structure and a fourth connecting structure. The third connecting structure and the fourth connecting structure can be the same functional groups, such as the binary amine groups of the residues from arginine, or can be different functional groups. Furthermore, when the central structure includes a plurality of amino acids, the molecule of the plasticizer can include more than five connecting structures.

The side-chain structure is a chain of multiple carbon atoms. The number of carbon atoms of the side-chain structure can be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20, etc. Moreover, the side-chain structure can include an oxygen atom to form an ether group, and the number of oxygen atoms of the side-chain structure can be 1, 2, 3, 4, 5, 6 or 7, etc.

The side-chain structure can be a saturated fatty acid. The number of carbon atoms of the saturated fatty acid can be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 or 36, such as acetic acid (lipid number C2:0), butyric acid (C4:0), hexanoic acid (C6:0), octanoic acid (C8:0), decanoic

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acid (C10:0), lauric acid (C12:0), lignoceric acid (C24:0), or hexatriacontanoic acid (C36:0).

The side-chain structure can be an unsaturated fatty acid. The number of carbon atoms of the unsaturated fatty acid can be 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 or 24, and the number of double bonds of the unsaturated fatty acid can be 1, 2, 3, 4, 5 or 6, such as paullinic acid (C20:1), dihomo- γ -linolenic acid (DGLA, C20:3), docosahexaenoic acid (DHA, C22:6), or tetracosenoic acid (C24:1).

The side-chain structure can be formed by continuous polymerization with ethylene glycol, polyethylene glycol (PEG), propylene glycol or polypropylene glycol (PPG) as monomers. Moreover, the side-chain structure can be formed by polymerization of the monomers selected from the group consisting of ethylene glycol, polyethylene glycol, propylene glycol and polypropylene glycol. The side-chain structure is formed by polymerization of the abovementioned monomers, the required molecular weight of the plasticizer can be controlled, and the hydrophilicity and hydrophobicity of the plasticizer are properly adjusted, so that it is favorable for the plasticizer performing the superior characteristics and enhancing the compatibility of the plasticizer mixing with the plastic.

The side-chain structure is connected to at least one of the first connecting structure and the second connecting structure, that is, the central structure is connected to the side-chain structure through the first connecting structure and/or the second connecting structure by a method of esterification, dehydration or peptide synthesis.

When the side-chain structure is connected to the amine group, an amide bond is formed, so that it is favorable for enhancing the efficiency of the plasticizer degraded by the enzyme, and further improving the biodegradability of the plasticizer. Moreover, when the side-chain structure is connected to the carboxyl group, an ester bond is formed. Furthermore, when the side-chain structure is connected to the hydroxyl group, an ether bond is formed. The ether bond can be split through hydrolysis reaction in a particular environment, so that it is favorable for enhancing the biodegradability of the plasticizer.

The plasticizer can further include at least one polar functional group connected to the side-chain structure, and the polar functional group can be located in the middle or at the end of the side-chain structure. Moreover, the polar functional group can be a carboxyl group ($-\text{COOH}$), a hydroxyl group ($-\text{OH}$), an amine group ($-\text{NH}_2$) or a phosphoryl group ($-\text{PO}(\text{OH})_2$). Furthermore, the plasticizer can include at least two of the polar functional group, which are selected from the group consisting of the carboxyl group, the hydroxyl group, the amine group and the phosphoryl group. The polar functional group is arranged according to different requirements, so that it is favorable for enhancing the hydrophilicity of the plasticizer and the compatibility between the plasticizer and the plastic, which helps the plasticizer mix with the plastic.

When a number of carbon atoms of the side-chain structure which is connected to the amine group is $n\text{NC}$, and a number of carbon atoms of the side-chain structure which is connected to the carboxyl group is $n\text{OC}$, the following condition is satisfied: $0 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 1.00$, wherein each of $n\text{NC}$ and $n\text{OC}$ is 0 or positive integer, but $n\text{NC}$ and $n\text{OC}$ are not 0 at the same time. Moreover, the following conditions can be satisfied: $0.01 \leq n\text{NC}/(n\text{NC}+n\text{OC})$; $n\text{NC}/(n\text{NC}+n\text{OC}) \leq 1.00$; $0.05 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.95$; $0.10 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.90$; $0.15 \leq n\text{NC}/(n\text{NC}+n\text{OC})$

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≤ 0.80 ; $0.20 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.70$; $0.25 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.60$; $0.30 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.50$; or $0.35 \leq n\text{NC}/(n\text{NC}+n\text{OC}) \leq 0.40$.

A number of oxygen atoms of the side-chain structure which is connected to the amine group is $n\text{NO}$. A number of oxygen atoms of the side-chain structure which is connected to the carboxyl group is $n\text{OO}$. A number of carbon atoms of the side-chain structure which is connected to the hydroxyl group is $n\text{O}'\text{C}$. A number of oxygen atoms of the side-chain structure which is connected to the hydroxyl group is $n\text{O}'\text{O}$. $n\text{NC}$ and $n\text{NO}$ of the side-chain structure are counted from the nitrogen atom of the amine group. $n\text{OC}$, $n\text{OO}$, $n\text{O}'\text{C}$ and $n\text{O}'\text{O}$ of the side-chain structure are counted from the oxygen atom of the carboxyl group or the hydroxyl group. The carbon atoms or the oxygen atoms in the polar functional group are not included as calculating $n\text{NC}$, $n\text{NO}$, $n\text{OC}$, $n\text{OO}$, $n\text{O}'\text{C}$ and $n\text{O}'\text{O}$. $n\text{O}'\text{C}$ is taken as $n\text{OC}$ and $n\text{O}'\text{O}$ is taken as $n\text{OO}$ during calculation.

When the molecular weight of the plasticizer is MwP , the following condition is satisfied: $450 \text{ Dalton} \leq \text{MwP}$. As the molecular weight of the plasticizer is larger, it is more difficult for the plasticizer to pass through the cell membrane, so that it is favorable for preventing the plasticizer directly passing through the cell membrane into the cell. Moreover, the following conditions can be satisfied: $\text{MwP} \leq 2000 \text{ Dalton}$; $475 \text{ Dalton} \leq \text{MwP} \leq 1000 \text{ Dalton}$; $500 \text{ Dalton} \leq \text{MwP}$; $525 \text{ Dalton} \leq \text{MwP}$; $550 \text{ Dalton} \leq \text{MwP}$; or $600 \text{ Dalton} \leq \text{MwP} \leq 1500 \text{ Dalton}$.

Each of the aforementioned features of the plasticizer can be utilized in various combinations for achieving the corresponding effects.

According to another aspect of the present disclosure, a plasticizer, which is biodegradable, has a molecule including at least two central structures, at least two connecting structures and a side-chain structure. Each of the central structures is connected to at least one of the connecting structures. Each of the central structures is connected to the side-chain structure through the connecting structures, that is, the central structures are all connected to the same side-chain structure. The detailed features of the central structures, the connecting structures and the side-chain structure are the same as the abovementioned plasticizer, and an explanation in this regard will not be provided again.

According to the present disclosure, a plastic product is provided, wherein the plastic product is biodegradable. The plastic product includes the aforementioned plasticizer and a polyester plastic, wherein the polyester plastic can be a polylactic acid, a polybutylene succinate, a poly(butylene adipate-co-terephthalate) or a polyhydroxyalkanoate (PHA), and the plasticizer is mixed with the polyester plastic. The type of the polyester plastic is chosen to ensure that the plasticizer is mixed with the plastic of high compatibility, so that it is favorable for enhancing the ductility of the plastic and reducing the possibility of releasing of the plasticizer. Moreover, the polyhydroxyalkanoate can be a polyhydroxybutyrate (PHB).

1st Embodiment

FIG. 1 is a structural schematic view of a molecule of a plasticizer **100** according to the 1st embodiment of the present disclosure. In FIG. 1, the molecule of the plasticizer **100** according to the 1st embodiment includes a central structure **110**, two connecting structures and a side-chain structure **130**.

The central structure **110** is a benzene derivative.

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The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **110**, respectively. The first connecting structure is an amine group **121**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **130** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The side-chain structure **130** is connected to the second connecting structure to form an ester bond **122'**.

2nd Embodiment

FIG. 2 is a structural schematic view of a molecule of a plasticizer **200** according to the 2nd embodiment of the present disclosure. In FIG. 2, the molecule of the plasticizer **200** according to the 2nd embodiment includes a central structure **210**, two connecting structures, a side-chain structure **230** and a polar functional group **260**.

The central structure **210** is a benzene derivative.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **210**, respectively. The first connecting structure is an amine group **221**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **230** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **230** is connected to the second connecting structure to form an ester bond **222'**.

The polar functional group **260** is connected to the side-chain structure **230**.

3rd Embodiment

FIG. 3 is a structural schematic view of a molecule of a plasticizer **300** according to the 3rd embodiment of the present disclosure. In FIG. 3, the molecule of the plasticizer **300** according to the 3rd embodiment includes a central structure **310**, two connecting structures and a side-chain structure **330**.

The central structure **310** is a benzene derivative.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **310**, respectively. The first connecting structure is an amine group **321**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **330** is formed by a first short chain **331** connected to a second short chain **332**. The first short chain **331** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **332** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **330** is connected to the second connecting structure to form an ester bond **322'**.

4th Embodiment

FIG. 4 is a structural schematic view of a molecule of a plasticizer **400** according to the 4th embodiment of the present disclosure. In FIG. 4, the molecule of the plasticizer **400** according to the 4th embodiment includes a central structure **410**, two connecting structures and a side-chain structure **430**.

The central structure **410** is a benzene derivative.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **410**, respectively. The first connecting

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structure is an amine group (not shown in drawings), and the second connecting structure is a carboxyl group **422**.

The side-chain structure **430** is a fatty acid. The side-chain structure **430** is connected to the first connecting structure to form an amide bond **421'**.

5th Embodiment

FIG. 5 is a structural schematic view of a molecule of a plasticizer **500** according to the 5th embodiment of the present disclosure. In FIG. 5, the molecule of the plasticizer **500** according to the 5th embodiment includes a central structure **510**, two connecting structures, two side-chain structures **530**, **540** and a polar functional group **560**.

The central structure **510** is a benzene derivative.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **510**, respectively. The first connecting structure is an amine group (not shown in drawings), and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **530** is formed by a first short chain **531** connected to a second short chain **532**. The first short chain **531** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **532** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **530** is connected to the second connecting structure to form an ester bond **522'**.

The side-chain structure **540** is a fatty acid. The side-chain structure **540** is connected to the first connecting structure to form an amide bond **521'**.

The polar functional group **560** is connected to the side-chain structure **530**.

6th Embodiment

FIG. 6 is a structural schematic view of a molecule of a plasticizer **600** according to the 6th embodiment of the present disclosure. In FIG. 6, the molecule of the plasticizer **600** according to the 6th embodiment includes a central structure **610**, two connecting structures, a side-chain structure **630** and a polar functional group **660**.

The central structure **610** is an amino acid and includes a residue **611**.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **610**, respectively. The first connecting structure is an amine group **621**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **630** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The side-chain structure **630** is connected to the second connecting structure to form an ester bond **622'**.

The polar functional group **660** is connected to the side-chain structure **630**.

7th Embodiment

FIG. 7 is a structural schematic view of a molecule of a plasticizer **700** according to the 7th embodiment of the present disclosure. In FIG. 7, the molecule of the plasticizer **700** according to the 7th embodiment includes a central structure **710**, two connecting structures and a side-chain structure **730**.

The central structure **710** is an amino acid and includes a residue **711**.

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The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **710**, respectively. The first connecting structure is an amine group **721**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **730** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **730** is connected to the second connecting structure to form an ester bond **722'**.

8th Embodiment

FIG. **8** is a structural schematic view of a molecule of a plasticizer **800** according to the 8th embodiment of the present disclosure. In FIG. **8**, the molecule of the plasticizer **800** according to the 8th embodiment includes a central structure **810**, two connecting structures and a side-chain structure **830**.

The central structure **810** is an amino acid and includes a residue **811**.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **810**, respectively. The first connecting structure is an amine group **821**, and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **830** is formed by a first short chain **831** connected to a second short chain **832**. The first short chain **831** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **832** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **830** is connected to the second connecting structure to form an ester bond **822'**.

9th Embodiment

FIG. **9** is a structural schematic view of a molecule of a plasticizer **900** according to the 9th embodiment of the present disclosure. In FIG. **9**, the molecule of the plasticizer **900** according to the 9th embodiment includes a central structure **910**, two connecting structures and a side-chain structure **930**.

The central structure **910** is an amino acid and includes a residue **911**.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **910**, respectively. The first connecting structure is an amine group (not shown in drawings), and the second connecting structure is a carboxyl group **922**.

The side-chain structure **930** is a fatty acid. The side-chain structure **930** is connected to the first connecting structure to form an amide bond **921'**.

10th Embodiment

FIG. **10** is a structural schematic view of a molecule of a plasticizer **1000** according to the 10th embodiment of the present disclosure. In FIG. **10**, the molecule of the plasticizer **1000** according to the 10th embodiment includes central structure **1010**, two connecting structures, two side-chain structures **1030**, **1040** and a polar functional group **1060**.

The central structure **1010** is an amino acid and includes a residue **1011**.

The two connecting structures are a first connecting structure and a second connecting structure and connected to the central structure **1010**, respectively. The first connecting

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structure is an amine group (not shown in drawings), and the second connecting structure is a carboxyl group (not shown in drawings).

The side-chain structure **1030** is formed by a first short chain **1031** connected to a second short chain **1032**. The first short chain **1031** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **1032** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **1030** is connected to the second connecting structure to form an ester bond **1022'**.

The side-chain structure **1040** is a fatty acid. The side-chain structure **1040** is connected to the first connecting structure to form an amide bond **1021'**.

The polar functional group **1060** is connected to the side-chain structure **1030**.

11th Embodiment

FIG. **11** is a structural schematic view of a molecule of a plasticizer **1100** according to the 11th embodiment of the present disclosure. In FIG. **11**, the molecule of the plasticizer **1100** according to the 11th embodiment includes a central structure **1110**, three connecting structures, three side-chain structures **1130**, **1140**, **1150** and a polar functional group **1160**.

The central structure **1110** includes two amino acids, and each of the two amino acids includes a residue **1111**, **1112**.

The three connecting structures are a first connecting structure, a second connecting structure and a third connecting structure and connected to the central structure **1110**, respectively. The first connecting structure is an amine group (not shown in drawings), and each of the second connecting structure and the third connecting structure is a carboxyl group (not shown in drawings). The third connecting structure is connected to the residue **1111**.

The side-chain structure **1130** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The side-chain structure **1130** is connected to the second connecting structure to form an ester bond **1122'**.

The side-chain structure **1140** is a fatty acid. The side-chain structure **1140** is connected to the first connecting structure to form an amide bond **1121'**.

The side-chain structure **1150** is formed by a first short chain **1151** connected to a second short chain **1152**. The first short chain **1151** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **1152** is formed by polymerization with propylene glycol or polypropylene glycol as monomers. The side-chain structure **1150** is connected to the third connecting structure to form an ester bond **1123'**.

The polar functional group **1160** is connected to the side-chain structure **1150**.

12th Embodiment

FIG. **12** is a structural schematic view of a molecule of a plasticizer **1200** according to the 12th embodiment of the present disclosure. In FIG. **12**, the molecule of the plasticizer **1200** according to the 12th embodiment includes a central structure **1210**, three connecting structures and three side-chain structures **1230**, **1240**, **1250**.

The central structure **1210** includes two amino acids, and each of the two amino acids includes a residue **1211**, **1212**.

The three connecting structures are a first connecting structure, a second connecting structure and a third connecting structure and connected to the central structure **1210**,

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respectively. Each of the first connecting structure and the third connecting structure is an amine group (not shown in drawings), and the second connecting structure is a carboxyl group (not shown in drawings). The third connecting structure is connected to the residue **1212**.

The side-chain structure **1230** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The side-chain structure **1230** is connected to the second connecting structure to form an ester bond **1222'**.

The side-chain structure **1240** is a fatty acid. The side-chain structure **1240** is connected to the first connecting structure to form an amide bond **1221'**.

The side-chain structure **1250** is a fatty acid. The side-chain structure **1250** is connected to the third connecting structure to form an amide bond **1223'**.

13th Embodiment

FIG. **13** is a structural schematic view of a molecule of a plasticizer **1300** according to the 13th embodiment of the present disclosure. In FIG. **13**, the molecule of the plasticizer **1300** according to the 13th embodiment includes a central structure **1310**, four connecting structures, three side-chain structures **1330**, **1340**, **1350** and a polar functional group **1360**.

The central structure **1310** includes three amino acids, and each of the three amino acids includes a residue **1311**, **1312**, **1313**.

The four connecting structures are a first connecting structure, a second connecting structure, a third connecting structure and a fourth connecting structure and connected to the central structure **1310**, respectively. The first connecting structure is an amine group **1321**, each of the second connecting structure and the third connecting structure is a carboxyl group (not shown in drawings), and the fourth connecting structure is an amine group (not shown in drawings). The third connecting structure and the fourth connecting structure are connected to the residue **1311** and the residue **1313**, respectively.

The side-chain structure **1330** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The side-chain structure **1330** is connected to the second connecting structure to form an ester bond **1322'**.

The side-chain structure **1340** is formed by a first short chain **1341** connected to a second short chain **1342**. The first short chain **1341** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. The second short chain **1342** is formed by polymerization with propyl-

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ene glycol or polypropylene glycol as monomers. The side-chain structure **1340** is connected to the third connecting structure to form an ester bond **1323'**.

The side-chain structure **1350** is a fatty acid. The side-chain structure **1350** is connected to the fourth connecting structure to form an amide bond **1324'**.

The polar functional group **1360** is connected to the side-chain structure **1330**.

14th Embodiment

FIG. **14** is a structural schematic view of a molecule of a plasticizer **1400** according to the 14th embodiment of the present disclosure. In FIG. **14**, the molecule of the plasticizer **1400** according to the 14th embodiment includes two central structures **1410a**, **1410b**, two connecting structures, a side-chain structure **1430** and two polar functional groups **1460a**, **1460b**.

Each of the central structures **1410a**, **1410b** is a benzene derivative.

Each of the central structures **1410a**, **1410b** is connected to the corresponding one of the connecting structures, that is, the central structure **1410a** is connected to one of the connecting structures, and the central structure **1410b** is connected to the other one of the connecting structures. Both of the connecting structures are carboxyl groups (not shown in drawings).

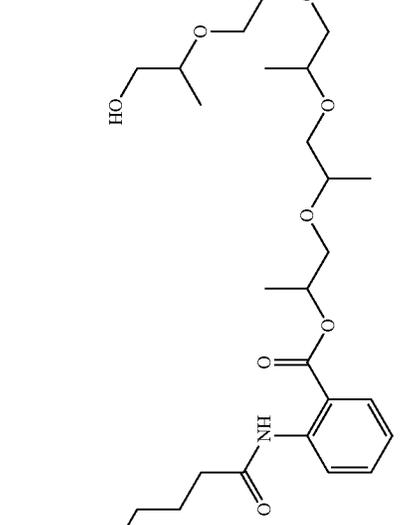
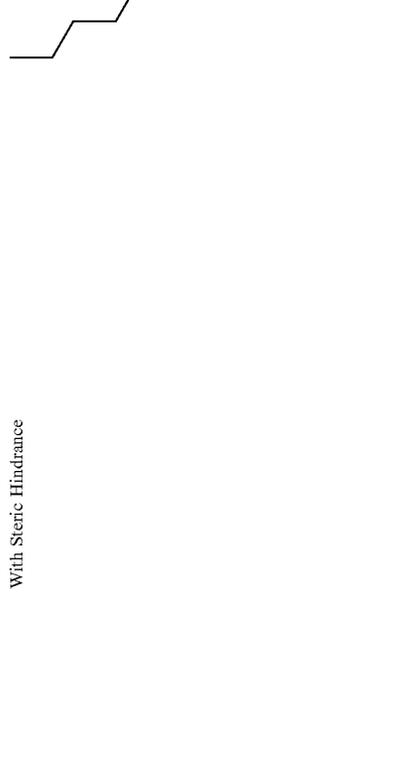
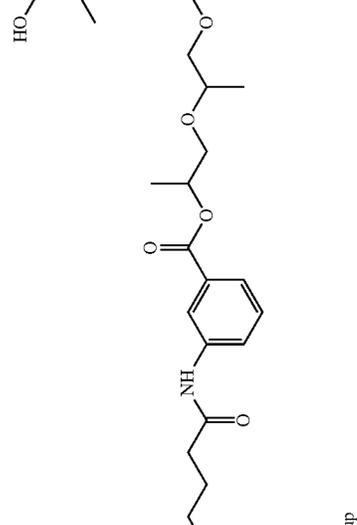
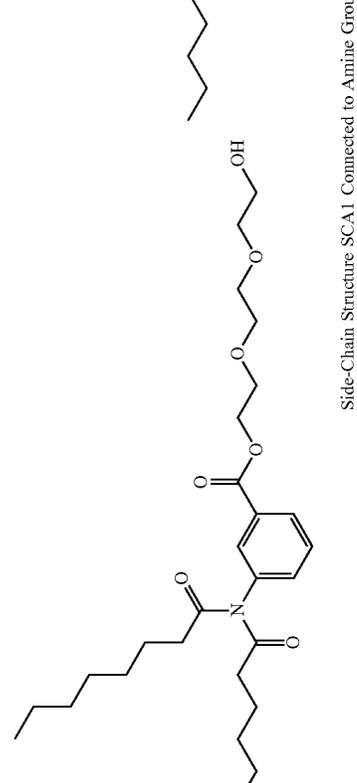
The side-chain structure **1430** is formed by polymerization with ethylene glycol or polyethylene glycol as monomers. Each of the central structures **1410a**, **1410b** is connected to the side-chain structure **1430** through the connecting structure to form an ester bond **1420a**, **1420b**.

Each of the polar functional groups **1460a**, **1460b** is connected to the corresponding one of the central structures **1410a**, **1410b**.

According to the above description of the present disclosure, the following specific examples are provided for further explanation.

In the 1st Example to the 8th Example, the side-chain structures connected to the amine group, the carboxyl group and the hydroxyl group are named as SCA, SCC and SCH, respectively. For the molecule of the plasticizer including a plurality of the side-chain structures connected to a same functional group, for example, two side-chain structures are connected to the amine group in the 1st Example, so the two side-chain structures are named as SCA1 and SCA2, respectively. The names of other side-chain structures follow the same rule, and an explanation in this regard will not be provided again.

-continued

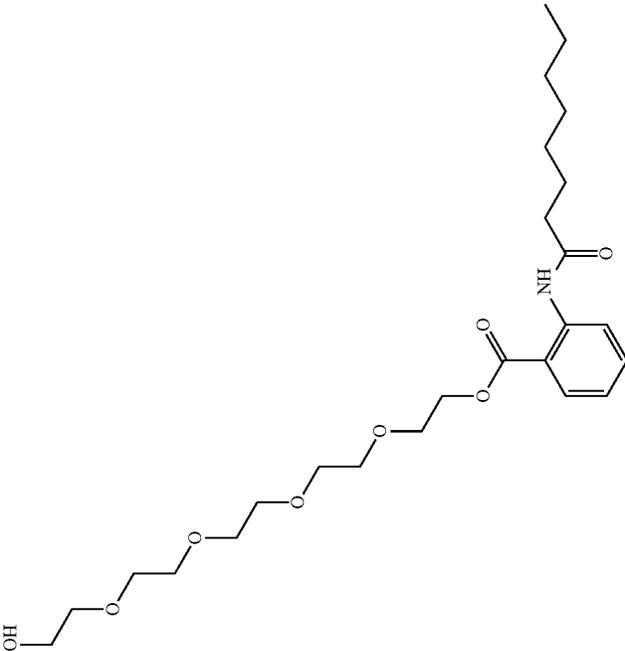
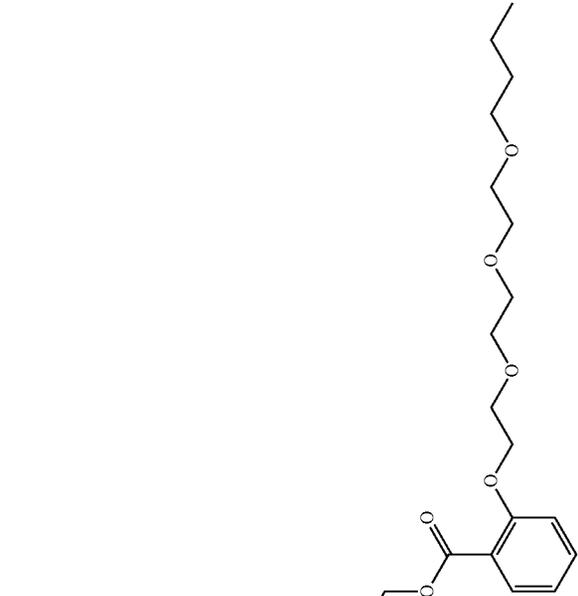
	1st Example With Steric Hindrance	2nd Example
Structure of Ortho Position		
Structure of Meta Position		
	Side-Chain Structure SCA1 Connected to Amine Group	Side-Chain Structure SCA2 Connected to Amine Group
nNC	8	8
nNO	0	0
nNC/(nNC + nNO)	1	1
Polar Functional Group	—	—
nNC	8	0
nNO	0	0
nNC/(nNC + nNO)	1	—
Polar Functional Group	—	—
	Side-Chain Structure SCC Connected to Carboxyl Group	

-continued

	1st Example	2nd Example
nOC	6	12
nOO	2	3
nOC/(nOC + nOO)	0.75	0.80
Polar Functional Group	OH	OH
	Relationship Between Numbers of Atoms of Side-Chain Structures SCA1, SCA2 and SCC	
nNC _{SCA1} /(nNC _{SCA1} + nOC _{SCC})	0.6	0.4
nNC _{SCA2} /(nNC _{SCA2} + nOC _{SCC})	0.6	0.0
nNC _{SCA1} /(nNC _{SCA1} + nOO _{SCC})	0.8	0.7
nNC _{SCA2} /(nNC _{SCA2} + nOO _{SCC})	0.8	0.0
nNO _{SCA1} /(nNO _{SCA1} + nOC _{SCC})	0.0	0.0
nNO _{SCA2} /(nNO _{SCA2} + nOC _{SCC})	0.0	0.0
nNO _{SCA1} /(nNO _{SCA1} + nOO _{SCC})	0.0	0.0
nNO _{SCA2} /(nNO _{SCA2} + nOO _{SCC})	0.0	0.0

Furthermore, in the 1st Example to the 8th Example, a number of carbon atoms and a number of oxygen atoms of the side-chain structure SCA1 are nNC_{SCA1} and nNO_{SCA1} , respectively. A number of carbon atoms and a number of oxygen atoms of the side-chain structure SCA2 are nNC_{SCA2} 5 and nNO_{SCA2} , respectively. A number of carbon atoms and a number of oxygen atoms of the side-chain structure SCC are nOC_{SCC} and nOO_{SCC} , respectively. SCA1, SCA2 and SCC are only for marking the side-chain structures to clearly understand the characteristics of the side-chain structures, 10 and do not make a difference to the calculation of carbon atoms and oxygen atoms of nNO , nNC , nOC and nOO as claimed. That is, nNC_{SCA1} is taken as nNC , nNO_{SCA1} is taken as nNO , nNC_{SCA2} is taken as nNC , nNO_{SCA2} is taken as nNO , nOC_{SCC} is taken as nOC and nOO_{SCC} is taken as nOO 15 during calculation. The information in the following tables has the same definition, and an explanation in this regard will not be provided again.

-continued

Molecular Formula Molecular Weight MwP (g/mol, Dalton)	3rd Example $C_{27}H_{41}NO_8$ 483.601	4th Example $C_{27}H_{46}O_9$ 514.655
Structure of Ortho Position		

-continued

Structure of Meta Position	3rd Example	4th Example
		
nNC	8	0
nNO	0	0
nNC/(nNC + nNO)	1	—
Polar Functional Group	—	—
nNC	0	0
nNO	0	0
nNC/(nNC + nNO)	—	—
Polar Functional Group	—	—
nOC	10	10
nOO	4	3
nOC/(nOC + nOO)	0.71	0.77
Polar Functional Group	OH	—

Side-Chain Structure SCA1 Connected to Amine Group

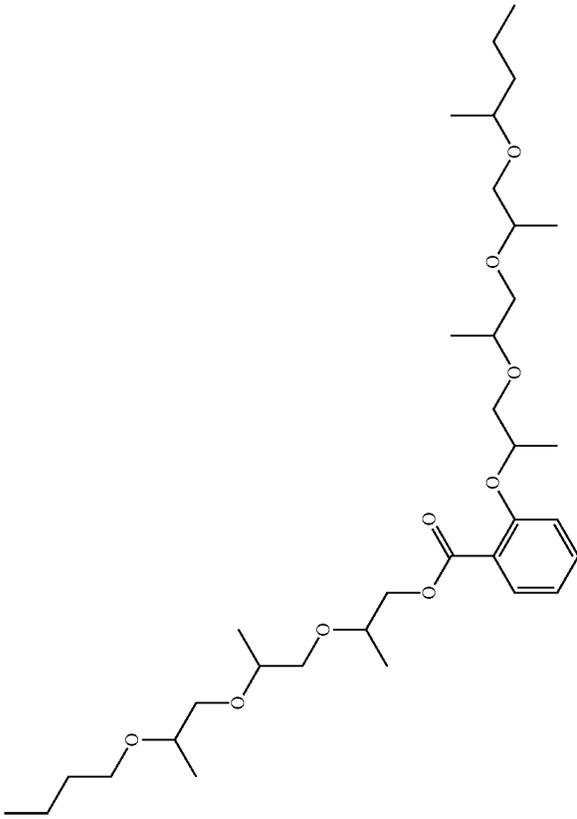
Side-Chain Structure SCA2 Connected to Amine Group

Side-Chain Structure SCC Connected to Carboxyl Group

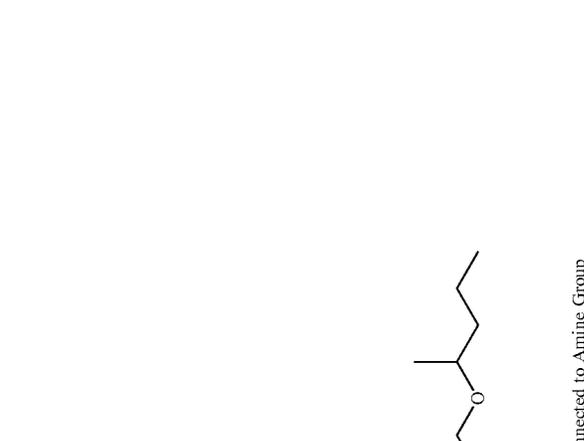
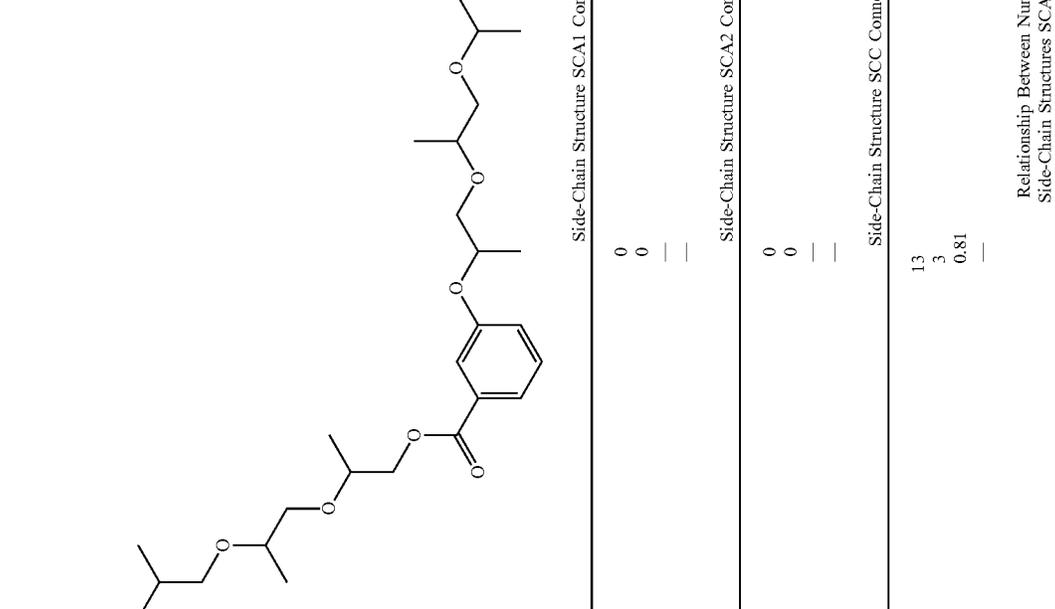
-continued

Group	3rd Example	Relationship Between Numbers of Atoms of Side-Chain Structures SCA1, SCA2 and SCC	4th Example
nNC _{SCA1} (nNC _{SCA1} + nOC _{SCC})	0.4		0.0
nNC _{SCA2} (nNC _{SCA2} + nOC _{SCC})	0.0		0.0
nNC _{SCA1} (nNC _{SCA1} + nOO _{SCC})	0.7		0.0
nNC _{SCA2} (nNC _{SCA2} + nOO _{SCC})	0.0		0.0
nNO _{SCA1} (nNO _{SCA1} + nOC _{SCC})	0.0		0.0
nNO _{SCA2} (nNO _{SCA2} + nOC _{SCC})	0.0		0.0
nNO _{SCA1} (nNO _{SCA1} + nOO _{SCC})	0.0		0.0
nNO _{SCA2} (nNO _{SCA2} + nOO _{SCC})	0.0		0.0
		Side-Chain Structure SCH1 Connected to Hydroxyl Group	10
nOC	—		3
nOC/(nOC + nOO)	—		0.77
Polar Functional Group	—		—
		Side-Chain Structure SCH2 Connected to Hydroxyl Group	
nOC	—		0
nOO	—		0
nOC/(nOC + nOO)	—		—
Polar Functional Group	—		—
		Side-Chain Structure SCH3 Connected to Hydroxyl Group	
nOC	—		0
nOO	—		0
nOC/(nOC + nOO)	—		—
Polar Functional Group	—		—

-continued

	5th Example	6th Example
Molecular Formula	17, 25-31H, 10-13, 18-24H2, 1-9H3	C ₂₄ H ₅₀ O ₉
Molecular Weight	C ₃₄ H ₆₀ O ₉	482.654
MwP (g/mol, Dalton)	612.843	—
Structure of Ortho Position		—

-continued

Structure of Meta Position	5th Example	6th Example
		
	Side-Chain Structure SCA1 Connected to Amine Group	
nNC	0	0
nNO	0	0
nNC/(nNC + nNO)	—	—
Polar Functional Group	—	—
	Side-Chain Structure SCA2 Connected to Amine Group	
nNC	0	0
nNO	0	0
nNC/(nNC + nNO)	—	—
Polar Functional Group	—	—
	Side-Chain Structure SCC Connected to Carboxyl Group	
nOC	13	0
nOO	3	0
nOC/(nOC + nOO)	0.81	—
Polar Functional Group	—	—
	Relationship Between Numbers of Atoms of Side-Chain Structures SCA1, SCA2 and SCC	

-continued

	5th Example	6th Example
nNC _{SC41} /(nNO _{SC41} + nOC _{SCC})	0.0	—
nNC _{SC42} /(nNO _{SC42} + nOC _{SCC})	0.0	—
nNC _{SC41} /(nNO _{SC41} + nOO _{SCC})	0.0	—
nNC _{SC42} /(nNO _{SC42} + nOO _{SCC})	0.0	—
nNO _{SC41} /(nNO _{SC41} + nOC _{SCC})	0.0	—
nNO _{SC42} /(nNO _{SC42} + nOC _{SCC})	0.0	—
nNO _{SC41} /(nNO _{SC41} + nOO _{SCC})	0.0	—
nNO _{SC42} /(nNO _{SC42} + nOO _{SCC})	0.0	—
Side-Chain Structure SCH1 Connected to Hydroxyl Group		
nOC	14	7
nOO	3	2
nOC/(nOC + nOO)	0.82	0.78
Polar Functional Group	—	—
Side-Chain Structure SCH2 Connected to Hydroxyl Group		
nOC	0	7
nOO	0	2
nOC/(nOC + nOO)	—	0.78
Polar Functional Group	—	—
Side-Chain Structure SCH3 Connected to Hydroxyl Group		
nOC	0	7
nOO	0	2
nOC/(nOC + nOO)	—	0.78
Polar Functional Group	—	—

	7th Example	8th Example
Central Structure	Propane-1,2,3-Triol	2-(2-Hydroxyethoxy) Propan-1-ol
Structure		
SMILES Notation	<chem>C(C(COC(COC(COCCOC)C)OCCOC)OCCOC)OC(C)OC(COCCOC)C</chem>	<chem>C(OCCOC(COCCOCC(C)C)OCCOC)OC(COCCOC)C</chem>
InChI Notation	InChI = 1S/C28H58O9/c1-8-11-29-14-15-30-16-17-33-28(22-36-26(6)20-34-24(4)18-31-12-9-2)23-37-27(7)21-35-25(5)19-32-13-10-3/h24-28H, 8-23H2, 1-7H3 C ₂₈ H ₅₈ O ₉ 538.761	InChI = 1S/C28H58O5/c1-9-27(10-2)15-13-17-29-19-23(5)31-21-25(7)33-22-26(8)32-20-24(6)30-18-14-16-28(11-3)12-4/h23-28H, 9-22H2, 1-8H3 C ₂₈ H ₅₈ O ₅ 474.763
Molecular Formula	C ₂₈ H ₅₈ O ₉	C ₂₈ H ₅₈ O ₅
Molecular Weight	538.761	474.763
MwP (g/mol, Dalton)		
nNC	0	0
nNO	0	0
nNC/(nNC + nNO)	—	—
Polar Functional Group	—	—
nNC	0	0
nNO	0	0
nNC/(nNC + nNO)	—	—
Polar Functional Group	—	—
nOC	0	0

Side-Chain Structure SCA1 Connected to Amine Group

Side-Chain Structure SCA2 Connected to Amine Group

Side-Chain Structure SCC Connected to Carboxyl Group

-continued

	7th Example	8th Example
nOO	0	0
nOC/(nOC + nOO) Polar Functional Group	—	—
Relationship Between Numbers of Atoms of Side-Chain Structures SCA1, SCA2 and SCC		
nNC _{SCA1} /(nNC _{SCA1} + nOC _{SCC})	—	—
nNC _{SCA2} /(nNC _{SCA2} + nOC _{SCC})	—	—
nNC _{SCA1} /(nNC _{SCA1} + nOO _{SCC})	—	—
nNC _{SCA2} /(nNC _{SCA2} + nOO _{SCC})	—	—
nNO _{SCA1} /(nNO _{SCA1} + nOC _{SCC})	—	—
nNO _{SCA2} /(nNO _{SCA2} + nOC _{SCC})	—	—
nNO _{SCA1} /(nNO _{SCA1} + nOO _{SCC})	—	—
nNO _{SCA2} /(nNO _{SCA2} + nOO _{SCC})	—	—
Side-Chain Structure SCH1 Connected to Hydroxyl Group		
nOC	9	11
nOO	2	1
nOC/(nOC + nOO) Polar Functional Group	0.82	0.92
Side-Chain Structure SCH2 Connected to Hydroxyl Group		
nOC	7	11
nOO	2	1
nOC/(nOC + nOO) Polar Functional Group	0.78	0.92
Side-Chain Structure SCH3 Connected to Hydroxyl Group		
nOC	9	0
nOO	2	0
nOC/(nOC + nOO) Polar Functional Group	0.82	—

	9th Example	10th Example	11th Example
IUPAC Name of Central Structure	Glycine	Alanine	Valine
Structural Formula			
Molecular Weight MWP (g/mol)	75.07	89.09	117.15
Abbreviation 1	Gly	Ala	Val
Abbreviation 2	G	A	V
Residue Property	Hydrophilic	Hydrophobic	Hydrophobic
Representative Structure as Side-Chain Structure Being PEG			
Representative Structure as Side-Chain Structure Being PPG			
Representative Structure as Side-Chain Structure Being Fatty Acid (CH ₃ (CH ₂) _n COOH, n ≥ 3)			
	Side-Chain Structure Being PEG and PPG		
Number of PEG Monomers	12	12	12
Number of PPG Monomers	0	0	0
Molecular Weight, MWP (g/mol, Dalton)	603.7	617.7	645.8
nNC	0	0	0
nOC	24	24	24
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	2	2	2
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	0	0	0
Number of PPG Monomers	12	12	12
Molecular Weight, MWP (g/mol, Dalton)	772.0	786.0	814.1
nNC	0	0	0
nOC	36	36	36
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	6	6	6
Number of PPG Monomers	6	6	6
Molecular Weight, MWP (g/mol, Dalton)	687.9	701.9	729.9

-continued

	9th Example	10th Example	11th Example
nNC	0	0	0
nOC	30	30	30
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	2	2	2
Number of PPG Monomers	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	453.6	467.6	495.7
nNC	0	0	0
nOC	19	19	19
nNO	0	0	0
nOO	7	7	7
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	5	5	5
Number of PPG Monomers	2	2	2
Molecular Weight, MwP (g/mol, Dalton)	411.5	425.5	453.6
nNC	0	0	0
nOC	16	16	16
nNO	0	0	0
nOO	7	7	7
nNC/(nNC + nOC)	0	0	0
nOC/nOO	2	2	2
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	5	5	5
Number of PPG Monomers	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	585.7	599.8	627.8
nNC	0	0	0
nOC	25	25	25
nNO	0	0	0
nOO	10	10	10
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	4	4	4
Number of PPG Monomers	4	4	4
Molecular Weight, MwP (g/mol, Dalton)	483.6	497.6	525.7
nNC	0	0	0
nOC	20	20	20
nNO	0	0	0
nOO	8	8	8
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	8	8	8
Number of PPG Monomers	8	8	8
Molecular Weight, MwP (g/mol, Dalton)	892.1	906.1	934.2
nNC	0	0	0
nOC	40	40	40

-continued

	9th Example	10th Example	11th Example
nNO	0	0	0
nOO	16	16	16
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid			
Number of PEG Monomers	3	3	3
Number of PPG Monomers	3	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	3	3	3
Molecular Weight, MwP (g/mol, Dalton)	465.5	479.5	507.6
nNC	5	5	5
nOC	15	15	15
nNO	0	0	0
nOO	6	6	6
nNC/(nNC + nOC)	0.25	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	8	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	651.8	665.8	693.8
nNC	7	7	7
nOC	24	24	24
nNO	0	0	0
nOO	8	8	8
nNC/(nNC + nOC)	0.23	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	5	5	5
Number of PPG Monomers	4	4	4
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	7	7	7
Molecular Weight, MwP (g/mol, Dalton)	667.7	681.7	709.8
nNC	9	9	9
nOC	22	22	22
nNO	0	0	0
nOO	9	9	9
nNC/(nNC + nOC)	0.29	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	2	2	2
Number of PPG Monomers	2	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	9	9	9
Molecular Weight, MwP (g/mol, Dalton)	447.4	461.4	489.5
nNC	11	11	11
nOC	10	10	10
nNO	0	0	0
nOO	4	4	4
nNC/(nNC + nOC)	0.52	0.52	0.52

-continued

	9th Example	10th Example	11th Example
nNC/(nNC + nOO)	0.73	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	5	5	5
Number of PPG Monomers	2	2	2
Fatty Acid	11	11	11
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	607.6	621.6	649.6
nNC	13	13	13
nOC	16	16	16
nNO	0	0	0
nOO	7	7	7
nNC/(nNC + nOC)	0.45	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	5	5	5
Fatty Acid	13	13	13
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	589.5	603.5	631.6
nNC	15	15	15
nOC	15	15	15
nNO	0	0	0
nOO	5	5	5
nNC/(nNC + nOC)	0.50	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	2	2	2
Number of PPG Monomers	2	2	2
Fatty Acid	15	15	15
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	531.4	545.4	573.5
nNC	17	17	17
nOC	10	10	10
nNO	0	0	0
nOO	4	4	4
nNC/(nNC + nOC)	0.63	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	0	0	0
Fatty Acid	34	34	34
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	593.1	607.2	635.2
nNC	36	36	36
nOC	0	0	0
nNO	0	0	0
nOO	0	0	0
nNC/(nNC + nOC)	1.00	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00	1.00
nNO/(nNO + nOC)	—	—	—
nNO/(nNO + nOO)	—	—	—

	12th Example	13th Example	14th Example
IUPAC Name of Central Structure	Leucine	Isoleucine	Phenylalanyl-nine
Structural Formula			
Molecular Weight MWP (g/mol)	131.17	131.17	165.19
Abbreviation 1	Leu	Ile	Phe
Abbreviation 2	L	I	F
Residue Property	Hydrophobic	Hydrophobic	Hydrophobic
Representative Structure as Side-Chain Structure Being PEG			
Representative Structure as Side-Chain Structure Being PPG			
Representative Structure as Side-Chain Structure Being Fatty Acid (CH ₃ (CH ₂) _n COOH, n ≥ 3)			
Side-Chain Structure Being PEG and PPG			
Number of PEG Monomers	12	12	12
Number of PPG Monomers	0	0	0
Molecular Weight, MWP (g/mol, Dalton)	659.8	659.8	693.8
nNC	0	0	0
nOC	24	24	24
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	2	2	2
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	0	0	0
Number of PPG Monomers	12	12	12
Molecular Weight, MWP (g/mol, Dalton)	828.1	828.1	862.1
nNC	0	0	0
nOC	36	36	36
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	6	6	6
Number of PPG Monomers	6	6	6

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	12th Example	13th Example	14th Example
Molecular Weight, MwP (g/mol, Dalton)	744.0	744.0	778.0
nNC	0	0	0
nOC	30	30	30
nNO	0	0	0
nOO	12	12	12
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	2	2	2
Number of PPG Monomers	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	509.7	509.7	543.7
nNC	0	0	0
nOC	19	19	19
nNO	0	0	0
nOO	7	7	7
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	5	5	5
Number of PPG Monomers	2	2	2
Molecular Weight, MwP (g/mol, Dalton)	467.6	467.6	501.6
nNC	0	0	0
nOC	16	16	16
nNO	0	0	0
nOO	7	7	7
nNC/nNC + nOC)	0	0	0
nOC/nOO	2	2	2
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	5	5	5
Number of PPG Monomers	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	641.8	641.8	675.9
nNc	0	0	0
nOC	25	25	25
nNO	0	0	0
nOO	10	10	10
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	4	4	4
Number of PPG Monomers	4	4	4
Molecular Weight, MwP (g/mol, Dalton)	539.7	539.7	573.7
nNC	0	0	0
nOC	20	20	20
nNO	0	0	0
nOO	8	8	8
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Number of PEG Monomers	8	8	8
Number of PPG Monomers	8	8	8

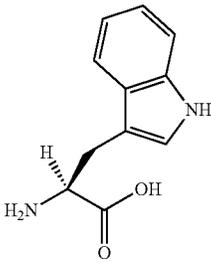
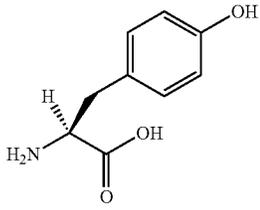
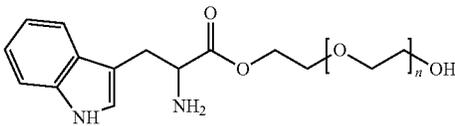
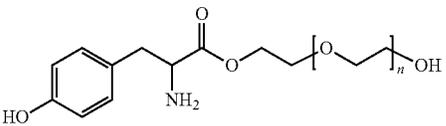
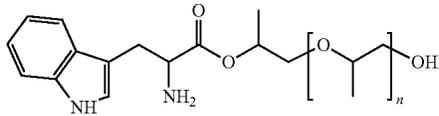
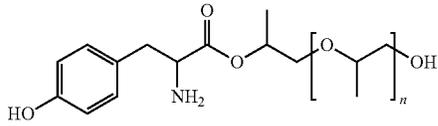
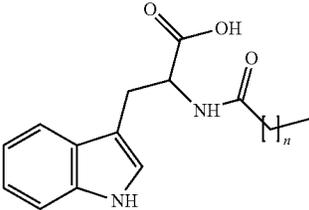
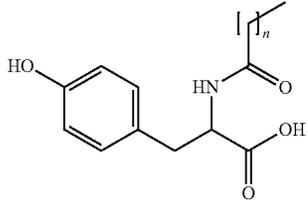
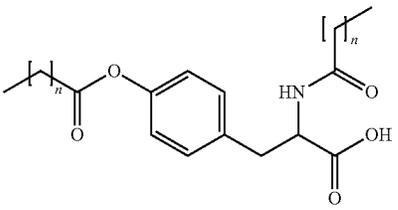
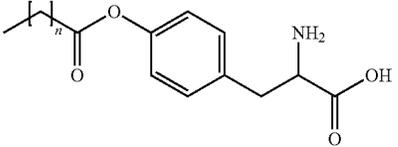
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	12th Example	13th Example	14th Example
Molecular Weight, MwP (g/mol, Dalton)	948.2	948.2	982.2
nNC	0	0	0
nOC	40	40	40
nNO	0	0	0
nOO	16	16	16
nNC/(nNC + nOC)	0	0	0
nOC/nOO	3	3	3
nNO/(nNO + nOC)	0	0	0
nNO/(nNO + nOO)	0	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid			
Number of PEG Monomers	3	3	3
Number of PPG Monomers	3	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	3	3	3
Molecular Weight, MwP (g/mol, Dalton)	521.6	521.6	555.6
nNC	5	6	5
nOC	15	15	15
nNO	0	0	0
nOO	6	6	6
nNC/(nNC + nOC)	0.25	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	8	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	5	5	5
Molecular Weight, MwP (g/mol, Dalton)	707.9	707.9	741.9
nNC	7	7	7
nOC	24	24	24
nNO	0	0	0
nOO	8	8	8
nNC/(nNC + nOC)	0.23	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	5	5	5
Number of PPG Monomers	4	4	4
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	7	7	7
Molecular Weight, MwP (g/mol, Dalton)	723.8	723.8	757.8
nNC	9	9	9
nOC	22	22	22
nNO	0	0	0
nOO	9	9	9
nNC/(nNC + nOC)	0.29	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	2	2	2
Number of PPG Monomers	2	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	9	9	9
Molecular Weight, MwP (g/mol, Dalton)	503.5	503.5	537.5

-continued

	12th Example	13th Example	14th Example
nNC	11	11	11
nOC	10	10	10
nNO	0	0	0
nOO	4	4	4
nNC/(nNC + nOC)	0.52	0.52	0.52
nNC/(nNC + nOO)	0.73	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	5	5	5
Number of PPG Monomers	2	2	2
Fatty Acid	11	11	11
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	663.7	663.7	697.7
nNC	13	13	13
nOC	16	16	16
nNO	0	0	0
nOO	7	7	7
nNC/(nNC + nOC)	0.45	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	5	5	5
Fatty Acid	13	13	13
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	645.6	645.6	679.6
nNC	15	15	15
nOC	15	15	15
nNO	0	0	0
nOO	5	5	5
nNC/(nNC + nOC)	0.50	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	2	2	2
Number of PPG Monomers	2	2	2
Fatty Acid	15	15	15
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	587.5	587.5	621.5
nNC	17	17	17
nOC	10	10	10
nNO	0	0	0
nOO	4	4	4
nNC/(nNC + nOC)	0.63	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00	0.00
Number of PEG Monomers	0	0	0
Number of PPG Monomers	0	0	0
Fatty Acid	34	34	34
CH ₃ (CH ₂) _n COOH, n = ?			
Molecular Weight, MwP (g/mol, Dalton)	649.2	649.2	683.3
nNC	36	36	36
nOC	0	0	0
nNO	0	0	0
nOO	0	0	0
nNC/(nNC + nOC)	1.00	1.00	1.00

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	12th Example	13th Example	14th Example
nNC/(nNC + nOO)	1.00	1.00	1.00
nNO/(nNO + nOC)	—	—	—
nNO/(nNO + nOO)	—	—	—
	15th Example	16th Example	
IUPAC Name of Central Structure	Tryptophan	Tyrosine	
Structural Formula			
Molecular Weight Mwp (g/mol)	204.23	181.19	
Abbreviation 1	Trp	Tyr	
Abbreviation 2	W	Y	
Residue Property	Hydrophobic	Hydrophilic	
Representative Structure as Side-Chain Structure Being PEG			
Representative Structure as Side-Chain Structure Being PPG			
Representative Structure 1 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)			
Representative Structure 2 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)	—		
Representative Structure 3 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)	—		

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	15th Example	16th Example
Side-Chain Structure Being PEG and PPG		
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	732.9	709.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	901.2	878.1
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	817.0	794.0
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	582.7	559.7
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	540.7	517.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0

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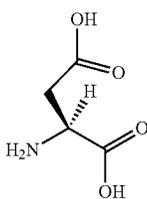
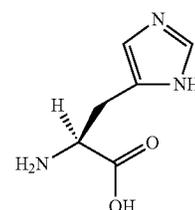
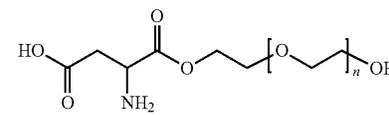
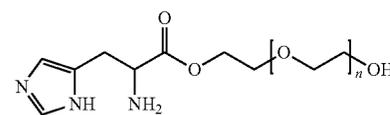
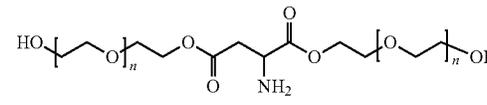
	15th Example	16th Example
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	714.9	691.9
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	612.8	589.7
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	1021.3	998.2
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, n = ?	3	3
Molecular Weight, MwP (g/mol, Dalton)	594.7	571.6
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, n = ?	5	5
Molecular Weight, MwP (g/mol, Dalton)	780.9	757.9
nNC	7	7
nOC	24	24

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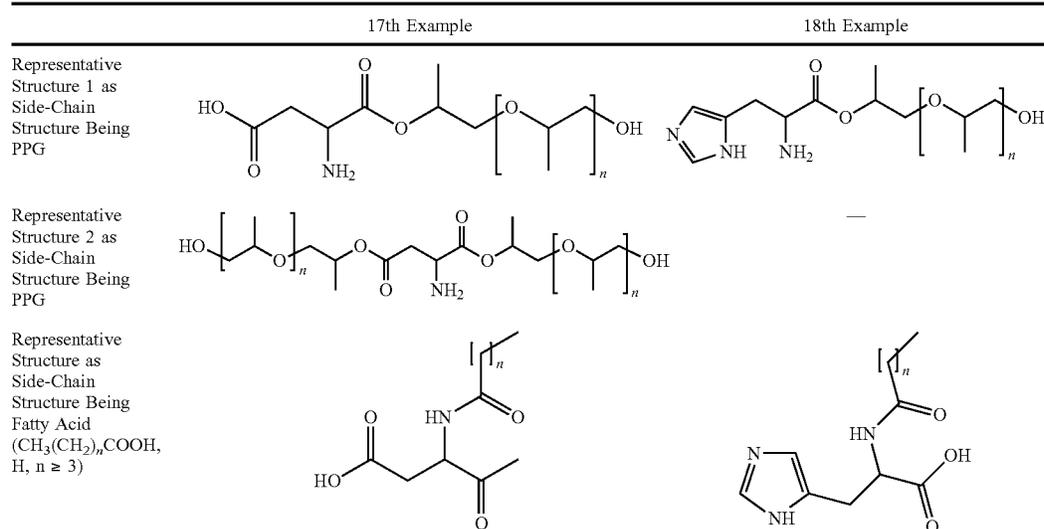
	15th Example	16th Example
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	6
Number of PPG Monomers	4	4
Fatty Acid	7	7
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	796.9	773.8
nNC	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	9	9
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	576.6	553.5
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.62	0.52
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	6	5
Number of PPG Monomers	2	2
Fatty Acid	11	11
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	736.7	713.7
nNC	13	13
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid	13	13
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	718.7	695.6
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00

-continued

	15th Example	16th Example
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	15	15
Molecular Weight, MwP (g/mol, Dalton)	660.6	637.5
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	34	34
Molecular Weight, MwP (g/mol, Dalton)	722.3	699.3
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	17th Example	18th Example
IUPAC Name of Central Structure	Aspartate	Histidine
Structural Formula		
Molecular Weight MwP (g/mol)	133.1	155.16
Abbreviation 1	Asp	His
Abbreviation 2	D	H
Residue Property	Acidic	Basic
Representative Structure 1 as Side-Chain Structure Being PEG		
Representative Structure 2 as Side-Chain Structure Being PEG		—

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Side-Chain Structure Being PEG and PPG

Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	661.7	683.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	830.0	852.1
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	745.9	768.0
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	511.6	533.7

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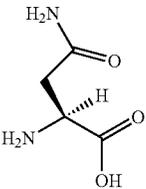
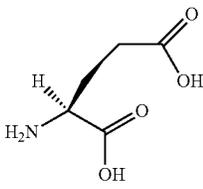
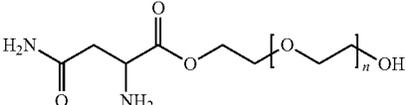
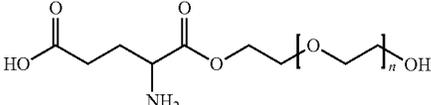
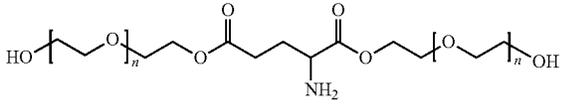
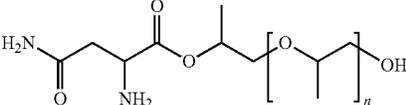
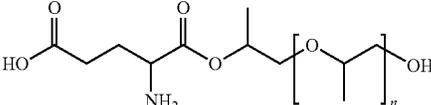
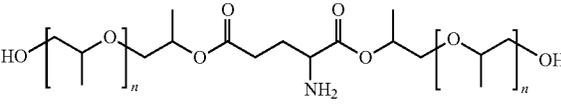
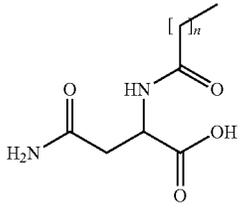
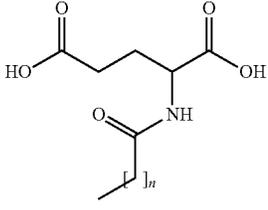
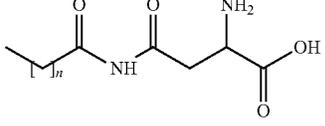
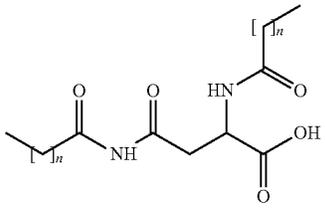
	17th Example	18th Example
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	469.5	491.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	643.8	665.8
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	541.6	563.7
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	950.2	972.2
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid	3	3
CH ₃ (CH ₂) _n COOH, n = ?		

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	17th Example	18th Example
Molecular Weight, MwP (g/mol, Dalton)	523.6	545.6
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	5	5
Molecular Weight, MwP (g/mol, Dalton)	709.8	731.9
nNC	7	7
nOC	24	24
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	7	7
Molecular Weight, MwP (g/mol, Dalton)	725.7	747.8
nNC	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	9	9
Molecular Weight, MwP (g/mol, Dalton)	505.4	527.5
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.52
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	11	11
Molecular Weight, MwP (g/mol, Dalton)	665.6	687.6
nNC	13	13
nOC	16	16

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	17th Example	18th Example
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	13	13
Molecular Weight, MwP (g/mol, Dalton)	647.6	669.6
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	15	15
Molecular Weight, MwP (g/mol, Dalton)	589.4	611.5
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	34	34
Molecular Weight, MwP (g/mol, Dalton)	651.2	673.2
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	19th Example	20th Example
IUPAC Name of Central Structure	Asparagine	Glutamate
Structural Formula		
Molecular Weight MWP (g/mol)	132.12	147.13
Abbreviation 1	Asn	Glu
Abbreviation 2	N	E
Residue Property	Hydrophilic	Acidic
Representative Structure 1 as Side-Chain Structure Being PEG		
Representative Structure 2 as Side-Chain Structure Being PEG	—	
Representative Structure 1 as Side-Chain Structure Being PPG		
Representative Structure 2 as Side-Chain Structure Being PPG	—	
Representative Structure 1 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)		
Representative Structure 2 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)		—
Representative Structure 3 as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)		—

-continued

	19th Example	20th Example
Side-Chain Structure Being PEG and PPG		
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	660.8	675.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	829.1	844.1
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	744.9	759.9
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	510.6	525.6
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	468.5	483.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0

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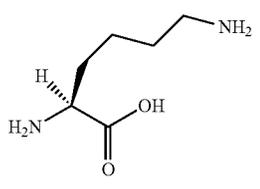
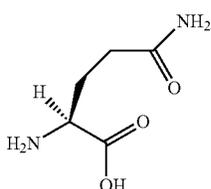
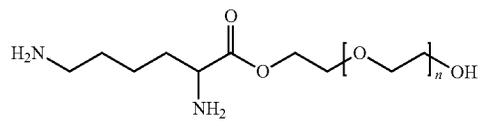
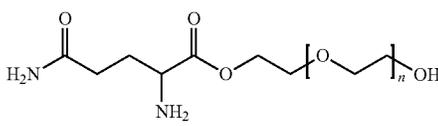
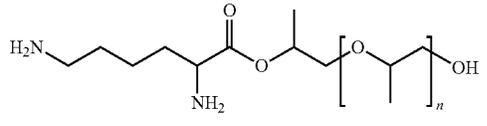
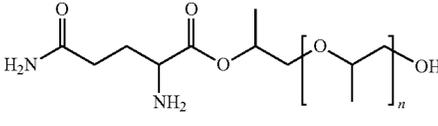
	19th Example	20th Example
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	642.8	657.8
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	540.6	555.7
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	949.2	964.2
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, n = ?	3	3
Molecular Weight, MwP (g/mol, Dalton)	522.6	537.6
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, n = ?	5	5
Molecular Weight, MwP (g/mol, Dalton)	708.8	723.8
nNC	7	7
nOC	24	24

-continued

	19th Example	20th Example
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4
Fatty Acid	7	7
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	724.8	739.8
nNC	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	9	9
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	504.4	519.5
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.62
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Fatty Acid	11	11
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	664.6	679.6
nNC	13	13
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.46
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid	13	13
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	646.6	661.6
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00

-continued

	19th Example	20th Example
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	15	15
Molecular Weight, MwP (g/mol, Dalton)	588.4	603.5
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid CH ₃ (CH ₂) _n COOH n = ?	34	34
Molecular Weight, MwP (g/mol, Dalton)	650.2	665.2
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	21st Example	22nd Example
IUPAC Name of Central Structure	Lysine	Glutamine
Structural Formula		
Molecular Weight MwP (g/mol)	146.19	146.15
Abbreviation 1	Lys	Gln
Abbreviation 2	K	Q
Residue Property	Basic	Hydrophilic
Representative Structure as Side-Chain Structure Being PEG		
Representative Structure as Side-Chain Structure Being PPG		

-continued

	21st Example	22nd Example
Representative Structure 1 as Side-Chain Structure Being Fatty Acid ($(\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		
Representative Structure 2 as Side-Chain Structure Being Fatty Acid ($(\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		—
Representative Structure 3 as Side-Chain Structure Being Fatty Acid ($(\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		—
Side-Chain Structure Being PEG and PPG		
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	674.8	674.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	843.1	843.1
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	759.0	758.9
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0

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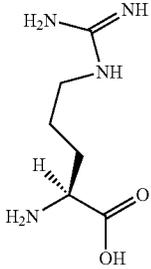
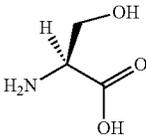
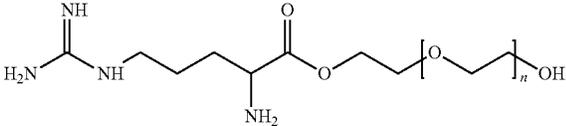
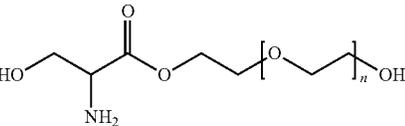
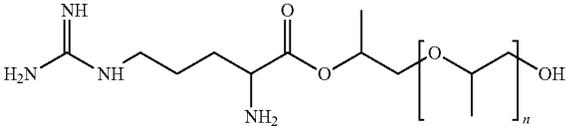
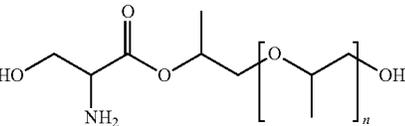
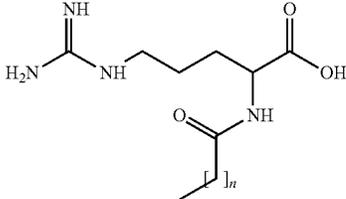
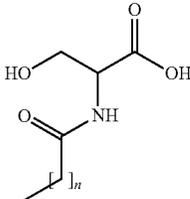
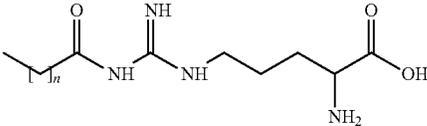
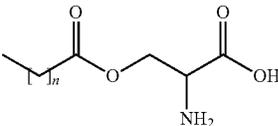
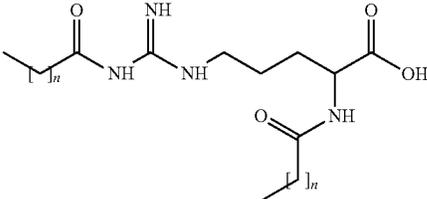
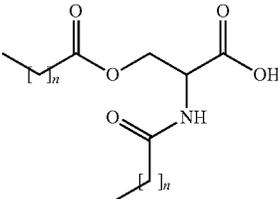
	21st Example	22nd Example
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	524.7	524.7
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number Of PEG Monomers	5	6
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	482.6	482.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	656.9	656.8
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	554.7	554.7
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	963.2	963.2
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0

-continued

	21st Example	22nd Example
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	3	3
Molecular Weight, MwP (g/mol, Dalton)	536.6	536.6
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$ $n = ?$	5	5
Molecular Weight, MwP (g/mol, Dalton)	722.9	722.8
nNC	7	7
nOC	24	24
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	7	7
Molecular Weight, MwP (g/mol, Dalton)	738.8	738.8
nNO	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	9	9
Molecular Weight, MwP (g/mol, Dalton)	518.5	518.5
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.52
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5

-continued

	21st Example	22nd Example
Number of PPG Monomers	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	11	11
Molecular Weight, MwP (g/mol, Dalton)	678.7	678.6
nNC	13	13
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.46	0.45
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	13	13
Molecular Weight, MwP (g/mol, Dalton)	660.6	660.6
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	15	15
Molecular Weight, MwP (g/mol, Dalton)	602.5	602.5
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	34	34
Molecular Weight, MwP (g/mol, Dalton)	664.3	664.2
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	23rd Example	24th Example
IUPAC Name of Central Structure	Arginine	Serine
Structural Formula		
Molecular Weight	174.2	105.09
MwP (g/mol)		
Abbreviation 1	Arg	Ser
Abbreviation 2	R	S
Residue Property	Basic	Hydrophilic
Representative Structure as Side-Chain Structure Being PEG		
Representative Structure as Side-Chain Structure Being PPG		
Representative Structure 1 as Side-Chain Structure Being Fatty Acid (CH ₃ (CH ₂) _n COOH, n ≥ 3)		
Representative Structure 2 as Side-Chain Structure Being Fatty Acid (CH ₃ (CH ₂) _n COOH, n ≥ 3)		
Representative Structure 3 as Side-Chain Structure Being Fatty Acid (CH ₃ (CH ₂) _n COOH, n ≥ 3)		
	Side-Chain Structure Being PEG and PPG	
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	702.8	633.7
nNC	0	0
nOC	24	24
nNO	0	0

-continued

	23rd Example	24th Example
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	871.1	802.0
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	787.0	717.9
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	552.7	483.6
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	510.6	441.5
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	684.9	615.8
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0

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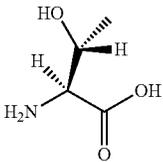
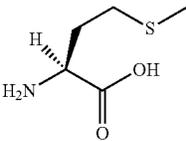
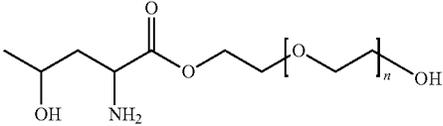
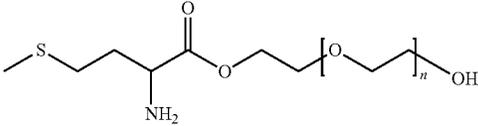
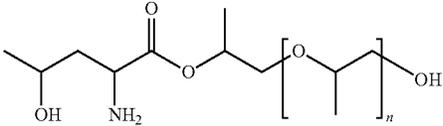
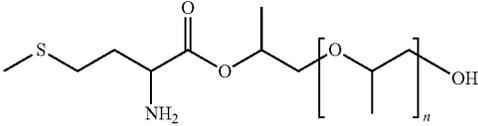
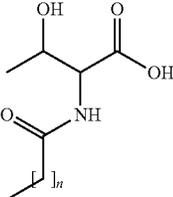
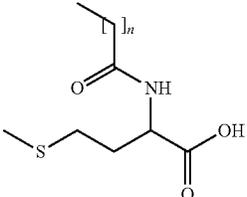
	23rd Example	24th Example
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	582.7	513.6
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	991.3	922.1
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid	3	3
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	564.7	495.5
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid	5	5
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	750.9	681.8
nNC	7	7
nOC	24	24
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4

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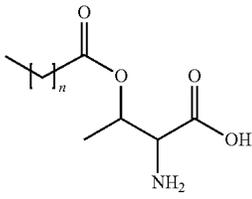
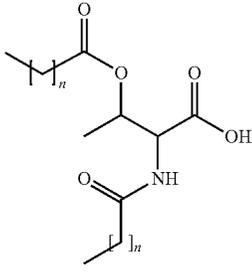
	23rd Example	24th Example
Fatty Acid	7	7
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	766.8	697.7
nNC	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.50
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	9	9
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	546.5	477.4
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.52
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Fatty Acid	11	11
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	706.7	637.6
nNC	13	13
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid	13	13
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	688.7	619.5
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	15	15
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		

-continued

	23rd Example	24th Example
Molecular Weight, MwP (g/mol, Dalton)	630.5	561.4
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	34	34
Molecular Weight, MwP (g/mol, Dalton)	692.3	623.2
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	25th Example	26th Example
IUPAC Name of Central Structure	Threonine	Methionine
Structural Formula		
Molecular Weight MwP (g/mol)	119.12	149.21
Abbreviation 1	Thr	Met
Abbreviation 2	T	M
Residue Property	Hydrophilic	Hydrophobic
Representative Structure as Side-Chain Structure Being PEG		
Representative Structure as Side-Chain Structure Being PPG		
Representative Structure 1 as Side-Chain Structure Being Fatty Acid ($\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		

-continued

	25th Example	26th Example
Representative Structure 2 as Side-Chain Structure Being Fatty Acid ($\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		—
Representative Structure 3 as Side-Chain Structure Being Fatty Acid ($\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n \geq 3$)		—
	Side-Chain Structure Being PEG and PPG	
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	647.8	677.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	816.1	846.2
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6
Molecular Weight, MwP (g/mol, Dalton)	731.9	762.0
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5

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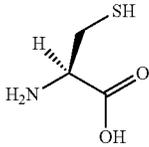
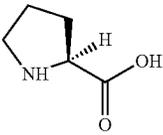
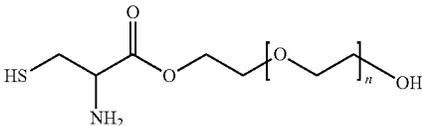
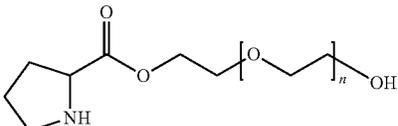
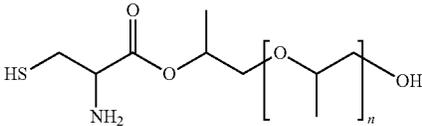
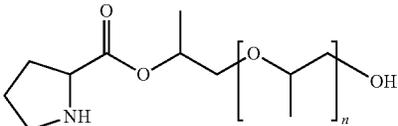
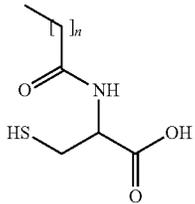
	25th Example	26th Example
Molecular Weight, MwP (g/mol, Dalton)	497.6	527.7
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	455.5	486.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	629.8	659.9
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	527.6	557.7
nNC	0	0
nOG	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8
Molecular Weight, MwP (g/mol, Dalton)	936.2	966.3
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3

-continued

	25th Example	26th Example
Number of PPG Monomers	3	3
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	3	3
Molecular Weight, MwP (g/mol, Dalton)	509.6	539.7
nNC	5	5
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.25
nNC/(nNC + nOO)	0.45	0.45
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	5	5
Molecular Weight, MwP (g/mol, Dalton)	695.8	725.9
nNC	7	7
nOC	24	24
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.23
nNC/(nNC + nOO)	0.47	0.47
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	7	7
Molecular Weight, MwP (g/mol, Dalton)	711.8	741.9
nNC	9	9
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.29
nNC/(nNC + nOO)	0.50	0.60
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	9	9
Molecular Weight, MwP (g/mol, Dalton)	491.4	521.5
nNC	11	11
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.52
nNC/(nNC + nOO)	0.73	0.73
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Fatty Acid $\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$	11	11

-continued

	25th Example	26th Example
Molecular Weight, MwP (g/mol, Dalton)	651.6	681.7
nNC	13	13
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.45
nNC/(nNC + nOO)	0.65	0.65
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	13	13
Molecular Weight, MwP (g/mol, Dalton)	633.6	663.7
nNC	15	15
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.50
nNC/(nNC + nOO)	0.75	0.75
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	15	15
Molecular Weight, MwP (g/mol, Dalton)	575.4	605.5
nNC	17	17
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.63
nNC/(nNC + nOO)	0.81	0.81
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid CH ₃ (CH ₂) _n COOH, n = ?	34	34
Molecular Weight, MwP (g/mol, Dalton)	637.2	667.3
nNC	36	36
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	1.00
nNC/(nNC + nOO)	1.00	1.00
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

	27th Example	28th Example
IUPAC Name of Central Structure	Cysteine	Proline
Structural Formula		
Molecular Weight MwP (g/mol)	121.16	115.13
Abbreviation 1	Cys	Pro
Abbreviation 2	C	P
Residue Property	Hydrophilic	Hydrophobic
Representative Structure as Side-Chain Structure Being PEG		
Representative Structure as Side-Chain Structure Being PPG		
Representative Structure as Side-Chain Structure Being Fatty Acid (CH3(CH2)nCOOH, n ≥ 3)		—
	Side-Chain Structure Being PEG and PPG	
Number of PEG Monomers	12	12
Number of PPG Monomers	0	0
Molecular Weight, MwP (g/mol, Dalton)	649.8	643.8
nNC	0	0
nOC	24	24
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	0	0
Number of PPG Monomers	12	12
Molecular Weight, MwP (g/mol, Dalton)	818.1	812.1
nNC	0	0
nOC	36	36
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	6	6
Number of PPG Monomers	6	6

-continued

	27th Example	28th Example
Molecular Weight, MwP (g/mol, Dalton)	734.0	727.9
nNC	0	0
nOC	30	30
nNO	0	0
nOO	12	12
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	2	2
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	499.7	493.6
nNC	0	0
nOC	19	19
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Molecular Weight, MwP (g/mol, Dalton)	457.6	451.6
nNC	0	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0	0
nOC/nOO	2	2
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	5	5
Number of PPG Monomers	5	5
Molecular Weight, MwP (g/mol, Dalton)	631.8	625.8
nNC	0	0
nOC	25	25
nNO	0	0
nOO	10	10
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	4	4
Number of PPG Monomers	4	4
Molecular Weight, MwP (g/mol, Dalton)	529.7	523.7
nNC	0	0
nOC	20	20
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Number of PEG Monomers	8	8
Number of PPG Monomers	8	8

-continued

	27th Example	28th Example
Molecular Weight, MwP (g/mol, Dalton)	938.2	932.2
nNC	0	0
nOC	40	40
nNO	0	0
nOO	16	16
nNC/(nNC + nOC)	0	0
nOC/nOO	3	3
nNO/(nNO + nOC)	0	0
nNO/(nNO + nOO)	0	0
Side-Chain Structure Being PEG, PPG and Fatty Acid		
Number of PEG Monomers	3	3
Number of PPG Monomers	3	3
Fatty Acid	3	0
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	511.6	421.5
nNC	5	0
nOC	15	15
nNO	0	0
nOO	6	6
nNC/(nNC + nOC)	0.25	0.00
nNC/(nNC + nOO)	0.45	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	8	8
Fatty Acid	5	—
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	697.9	579.8
nNC	7	0
nOC	24	24
nNO	0	0
nOO	8	8
nNC/(nNC + nOC)	0.23	0.00
nNC/(nNC + nOO)	0.47	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	4	4
Fatty Acid	7	—
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	713.8	567.7
nNC	9	0
nOC	22	22
nNO	0	0
nOO	9	9
nNC/(nNC + nOC)	0.29	0.00
nNC/(nNC + nOO)	0.50	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	9	—
$\text{CH}_3(\text{CH}_2)_n\text{COOH}$, $n = ?$		
Molecular Weight, MwP (g/mol, Dalton)	493.5	319.4

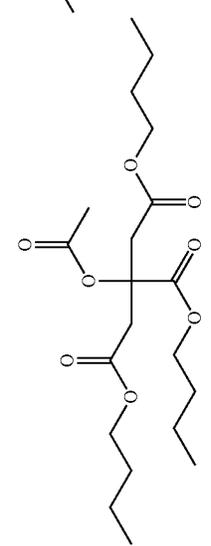
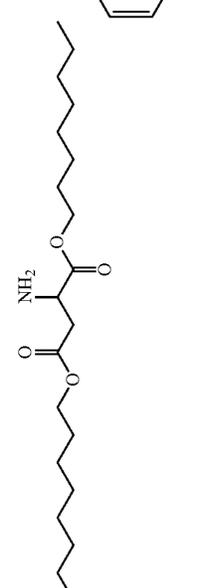
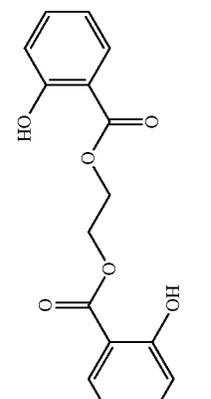
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	27th Example	28th Example
nNC	11	0
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.52	0.00
nNC/(nNC + nOO)	0.73	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	5	5
Number of PPG Monomers	2	2
Fatty Acid	11	—
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	653.6	451.6
nNC	13	0
nOC	16	16
nNO	0	0
nOO	7	7
nNC/(nNC + nOC)	0.45	0.00
nNC/(nNC + nOO)	0.65	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	5	5
Fatty Acid	13	—
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	635.6	405.5
nNC	15	0
nOC	15	15
nNO	0	0
nOO	5	5
nNC/(nNC + nOC)	0.50	0.00
nNC/(nNC + nOO)	0.75	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	2	2
Number of PPG Monomers	2	2
Fatty Acid	15	—
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	577.5	319.4
nNC	17	0
nOC	10	10
nNO	0	0
nOO	4	4
nNC/(nNC + nOC)	0.63	0.00
nNC/(nNC + nOO)	0.81	0.00
nNO/(nNO + nOC)	0.00	0.00
nNO/(nNO + nOO)	0.00	0.00
Number of PEG Monomers	0	0
Number of PPG Monomers	0	0
Fatty Acid	34	0
CH ₃ (CH ₂) _n COOH, n = ?		
Molecular Weight, MwP (g/mol, Dalton)	639.2	115.1
nNC	36	0
nOC	0	0
nNO	0	0
nOO	0	0
nNC/(nNC + nOC)	1.00	—

-continued

	27th Example	28th Example
nNC/(nNC + nOO)	1.00	—
nNO/(nNO + nOC)	—	—
nNO/(nNO + nOO)	—	—

FIG. 15 shows results of biodegradation tests of the comparison, the 29th Example and the 30th Example. The biodegradation tests (ASTM 5338) of the plasticizers with different molecular structures are performed below. The comparison, the 29th Example and the 30th Example are tested, and the degrees of degradation under different days are listed in the following table.

Comparison		29th Example	30th Example
Central Structure	Citric Acid Derivative	Amino Acid Derivative	Bezene Derivative
Product Name	Acetyl Tributyl Citrate	Dioctyl DL-Aspartate	Ethylene Glycol Disalicylate
Structural Formula			
Reactant 1		Aspartate	Salicylic Acid
Reactant 2		Octanol	Ethylene Glycol
days		Degree of Degradation (%)	
0	0	0	0
3	1.53	6.70	3.21
7	13.22	8.53	1.97
12	20.84	20.53	1.09
15	25.38	26.53	1.87
19	26.71	35.22	4.13
24	28.89	44.08	6.63
28	30.29	48.75	13.13
33	29.64	51.62	17.63
36	33.87	53.72	26.70
40	33.87	55.78	33.47
45	34.64	57.19	38.10
49	39.24	58.41	43.93
54	39.81	59.35	47.28
58	41.33	59.61	60.14
63	42.10	59.85	67.90
67	41.59	60.34	69.50
71	42.04	62.58	71.37
75	42.47	63.96	72.99
81	42.89	63.75	73.19
85	44.19	62.72	73.19
89	44.65	64.14	73.53
93	44.65	65.04	78.89
98	44.24	65.04	78.51
102	44.86	66.44	78.14
105	44.36	66.44	78.50
109	43.39	66.25	81.63
114	44.42	66.04	81.09
118	44.11	66.80	84.55
124	44.11	66.80	84.55
128	44.73	67.01	86.04

-continued

	Comparison	29th Example	30th Example
132	44.88	66.81	86.55
137	45.54	66.81	86.81
140	45.19	66.81	86.58
144	45.51	66.01	86.58
147	45.18	64.81	87.69
151	45.18	64.62	88.54
155	45.18	64.23	88.54
158	45.00	65.50	87.80
161	45.00	66.30	87.80
165	45.00	66.92	87.80
168	44.78	65.84	88.40
172	43.19	67.51	89.55
175	43.19	69.97	89.91
179	42.55	71.93	91.46

According to the present disclosure, the biodegradable plasticizer is developed by investigating a novel molecular structure. The plasticizer has the abilities of improving the plastic texture, meeting the requirements for widespread applications, and further enhancing the degradation and cycle of the plastic. The plasticizer includes the first connecting structure and the second connecting structure, includes the benzene derivative and/or the amino acid as the central structure, and is grafted with the side-chain structure of the chain with multiple carbon atoms. The plasticizer can further include the polar functional group to adjust the hydrophilicity and hydrophobicity of the plasticizer. The plasticizer, which reaches desire durability, heat resistance, impact resistance and flexibility, and is harmless to human body, hard to release and low-cost, is developed to meet the target of high biodegradability.

The foregoing description, for purpose of explanation, has been described with reference to specific embodiments and examples. It is to be noted that Tables show different data of the different examples; however, the data of the different examples are obtained from experiments. The embodiments and examples were chosen and described in order to best explain the principles of the disclosure and its practical applications, to thereby enable others skilled in the art to best utilize the disclosure and various embodiments or examples with various modifications as are suited to the particular use contemplated. The embodiments and examples depicted above and the appended drawings are exemplary and are not intended to be exhaustive or to limit the scope of the present disclosure to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

What is claimed is:

1. A plasticizer, which is biodegradable, a molecule of the plasticizer comprising:

a central structure comprising at least one amino acid; and at least two side-chain structures, wherein each of the at least two side-chain structures is a chain of multiple carbon atoms, an amide bond is formed as one of the at least two side-chain structures connected to an amine group of the at least one amino acid, and an ester bond is formed as another one of the at least two side-chain structures connected to a carboxyl group of the at least one amino acid;

wherein a number of carbon atoms of the side-chain structure which is connected to the amine group is nNC, a number of carbon atoms of the side-chain structure which is connected to the carboxyl group is nOC, and the following condition is satisfied:

$$0.01 \leq nNC/(nNC+nOC) < 1.00;$$

wherein nNC is positive integer and nOC is positive integer.

2. The plasticizer of claim 1, wherein the following condition is satisfied:

$$0.20 \leq nNC/(nNC+nOC) \leq 0.70.$$

3. The plasticizer of claim 2, wherein the following condition is satisfied:

$$0.30 \leq nNC/(nNC+nOC) \leq 0.50.$$

4. The plasticizer of claim 1, wherein the number of carbon atoms of the side-chain structure which is connected to the amine group is nNC, a number of oxygen atoms of the side-chain structure which is connected to the carboxyl group is nOO, and the following condition is satisfied:

$$0.45 \leq nNC/(nNC+nOO) \leq 1.00.$$

5. The plasticizer of claim 1, wherein the at least one amino acid is aspartate acid.

6. The plasticizer of claim 1, wherein the central structure comprises at least two of the amino acid.

7. The plasticizer of claim 1, wherein a molecular weight of the plasticizer is MwP, and the following condition is satisfied:

$$450 \text{ Dalton} \leq MwP.$$

8. The plasticizer of claim 1, further comprising:

at least one polar functional group connected to one of the at least two side-chain structures, wherein the at least one polar functional group is a carboxyl group, a hydroxyl group, an amine group or a phosphoryl group.

9. The plasticizer of claim 8, wherein the plasticizer comprises at least two of the polar functional group, which are selected from the group consisting of the carboxyl group, the hydroxyl group, the amine group and the phosphoryl group.

10. A plastic product, which is biodegradable, comprising: the plasticizer of claim 1; and

a polyester plastic, wherein the polyester plastic is a polylactic acid, a polybutylene succinate, a poly (butylene adipate-co-terephthalate) or a polyhydroxyalkanoate;

wherein the plasticizer is mixed with the polyester plastic.

11. The plasticizer of claim 1, wherein the number of carbon atoms of the side-chain structure which is connected to the carboxyl group is nOC, a number of oxygen atoms of the side-chain structure which is connected to the carboxyl group is nOO, and the following condition is satisfied:

$$2 \leq nOC/nOO.$$

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