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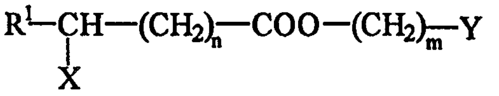
(54) Title: OMEGA-AMINO ACID DERIVATIVES, PROCESSES OF THEIR PREPARATION AND THEIR USE



$$R^1-\underset{\displaystyle X}{\underset{|}{C}}H-(CH_2)_n-COO-(CH_2)_m-Y \qquad (I)$$

(57) Abstract

The invention relates to ω-amino acid derivatives of general formula (I), wherein R^1 is H or CH_3, X is H or NR^2R^3, wherein R^2 is H, CH_3, COH or $COCH_3$ and R^3 is H, CH_3 or COO^-Z, wherein Z is $R^2R^3\ NH^+CHR^1(CH_2)_nCOO(CH_2)_mCH_2Y$; Y is H, CH_3 or NHR^4, wherein R^4 is $COO^-NH_3^+CH_2(CH_2)_mOOC(CH_2)_nCH_3$, the meaning of group $(CH_2)_m$ being selected from alkyls, secondary alkyls, monocycloalkyls, bicycloalkyls and tricycloalkyls having from 4 to 15 carbon atoms and n having a value of from 3 to 14. ω-Amino acid derivatives of the invention are prepared by reacting a primary or secondary or monocyclic or bicyclic or tricyclic alcohol with the reaction product of an amino acid or an N-substituted amino acid with thionyl chloride, whereafter the amino group, which has been released by an amine, reacts with carbon dioxide providing a derivative of carbamic acid, or by directly reacting a primary or secondary or monocyclic or bicyclic or tricyclic alcohol with an N-substituted amino acid in the presence of a condensing agent giving the corresponding ester of the N-substituted amino acid. Thus produced compounds of formula (I) can be used as transdermal penetration enhancers. Incorporation of from 0.1 w/w percent to 5.0 w/w percent of a compound of the invention as a transdermal penetration enhancer in the vehicle of a topically applied pharmaceutical or cosmetic composition enhances transdermal penetration of pharmaceutical agents through the human or animal skin. Included further are transdermal penetration enhancers consisting of at least one compound of formula (I).

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Title: ω-amino acid derivatives, processes of their preparation and their use

FIELD OF INVENTION

This invention relates to the compounds based on ω-amino acids, processes of preparation of them. The invention is also directed to application of these compounds as efficaciaous and safe transdermal penetration enhancers, and enhancers of transdermal penetration formed by these compounds.

BACKGROUND OF THE INVENTION

The potential advantages of transdermal administration of drugs into systemic body circulation comprise mainly principal restriction of the undesirable influence of the first pass effect based on biotransformation of agent(s) in the liver, decrease of the risk of overdosing and the risk of undesirable side effects of drug(s). Other advantages are noninvasive and continual character of administration and possibility of simple interruption of it when problematic situations arise.

During several past decades, the research effort has been oriented for using transdermal route of drug administration in the form of practically usable pharmaceutical preparations. A series of significant results has been reached in this field and has brought successes in the therapeutic and, consequently, in the commercial area. An extensive outline of this topic can be found in the review by Cleary, G. W.: Transdermal delivery systems: A medical rationale. In: Shah, V. P., Maibach, H. I.; Topical Drug Bioavailability, Bioequivalence and Penetration. Plenum Press, New York, London, 1993. pp. 16 – 68, and/or in the compendium by Chien, Y. W.: Novel Drug Delivery Systems. 2nd Ed., Marcel Dekker, New York, Basel, Hong Kong, 1992, 797 pp.

Transdermal penetration of drugs as such is principally limited by natural barrier properties of the skin for majority of substances. Therefore various approaches enabling transdermal absorption of agents in a reversible way are used. They include, e.g., occlusion, optimisation of polarity properties of vehicles, iontophoresis, sonophoresis, application of a concept of prodrugs and the use of transdermal absorption enhancers (acceleratns or enhancers of skin penetration or permeation). The given problem is dealt in the monography by Walters, K.A., Hadgraft, J.(Eds.): Pharmaceutical Skin Penetration enhancement. Marcel Dekker, New York, Basel, Hong Kong 1993, 440 pp.

Transdermal penetration enhancers are substances, that interact with skin components or with pharmaceutical preparation components or with active agent(s) to increase the permeability of the skin for these agents in a reversible way. Enhancers of transdermal penetration extend possibilities of topical administration of agents with the purpose of systemic as well as local treatment by this route.

Information available on this topic up to 1981 was extensively dealt in the monography by Barry, B.W. Dermatological Formulations. Percuataneous Absorption. Marcel Dekker, New York, Basel, 1983, 408 pp. Newer information dealing with the given field are disposable in the article by Walters, K.A.: Penetration enhancers and their use in transdermal therapeutic systems. In: Hadgraft, J., Guy, R.H. (Eds.): Transdermal Drug Delivery. New York, Marcel Dekker, 1989, pp. 197–246 and/or in an extensive outline by Williams, A.C., Barry, B.W.: Skin absorption enhancers. CRC Crit. Rev. Ther. Drug Carrier Systems, 9 (3,4), 1992, pp. 305–353. A substantial outline comprising patent literature in the field of permeation enhancers since 1992 is given in the work by Santus, G. C., Baker, R. W.: Transdermal enhancer patent literature. J. Control. Rel., 25, 1993, pp. 1-20. Topical information dealing with the problem of skin absorption enhancers are reviewed by Kalbitz, J., Neubert, R., Wohlrab, W.: Modulation der Wirkstoffpenetration in die Haut. Pharmazie 51(9), 1996, pp. 619–637 and/or in the monography by Ranade, V. V., Hollinger, M. A.: Drug Delivery Systems. CRC Press, Boca Raton, 1995, 364 pp.

The use of permeation enhancers or their combinations for transdermal administration of various drug(s) is described in numerous recent patents, such as PCT Int. Appl. WO 9402, 119; PCT Int. Appl. WO 9323,019; PCT Int. Appl.WO 9323,025; Eur. Pat. Appl. EP 569, 338; PCT Int. Appl. 9325, 197; Eur. Pat. Appl. EP 581,587; Eur. Pat. Appl. EP 582,458; Eur. Pat. Appl. EP 680,759; Eur. Pat. Appl. 644,922; PCT Int. Appl. WO 9303,697; PCT Int. Appl. WO 9603,131; PCT Int. Appl. WO 9706,788.

There is a large number of substances interacting with the skin and its *stratum corneum*. Transdermal penetration enhancers as substances used in pharmaceutical preparations have to meet a set of qualitative criteria; they must not be toxic, they must not irritate, allergize or sensitize the skin and they should be pharmacologically inert at the concentrations required to exert adequate permeation action. Their effect shoud be immediate, predictive and reversible. At the same time they should be easily incorporated into pharmaceutical preparations as well as cosmetically acceptable (addapted from: Barry, B.W.: Dermatological Formulations. Percutaneous Absorption. Marcel Dekker, New York, Basel, 1983, pp. 167-172; Hadgraft, J.: Penetration enhancers in percutaneous absorption. Pharm. Int., 5, 1984, pp. 252-4; Pfister, W. R., Hsieh, D. S. T.: Permeation enhancers compatible with transdermal drug delivery systems. Part I., II. Pharm. Technol. Int., 3 (1) 1991, pp. 32-6, 3 (2), pp.28-32.

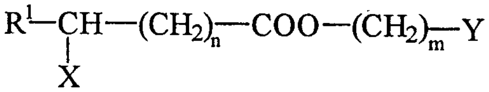
It is understandable that no univeral permeation enhancer has not been and probably would not be identified.

Derivatives of ω-amino acids, both cyclic and linear, can be included, however, among very promising and recently intensively studied substances exerting enhancing effect on transdermal penetration and permeation. The most significant substance of this group is 1-dodecylazacycloheptan-2-one (laurocapram, Azone®), patented in 1976 (Rajadhyaksha, V. J., Vieo, M.: U.S. Pat. 3,989,815 and U.S. Pat. 3,989,916). Some other substances being used for this purpose are aryl-methyl-2-pyrrolidone (U.S. Patent 3, 969, 516) and, for instance, derivatives of azepanone substituted in various ways (Santus, G. C., Baker, R.W.: J. Control. Release 25, 1993, pp. 1-20). Their disadvantage is that they cannot be easily dispersed in aqueous solutions and their effect is inhibited by the presence of some auxiliary substances commonly used as constituents in topical preparations. For instance, auxiliary substances of the paraffinic carbohydrate type (e.g., petrolatum) can completely inhibit permeation enhancing effect of laurocapram (Stoughton, R.B., McClure, W.O.: Azone®: A new non-toxic enhancer of cutaneous penetration. Drug. Dev. Ind. Pharm. 9, 1983, pp. 725-744). Within the group of linear derivatives of ω-amino acids, esters of lysine (Eur. Pat. Appl. No. 84200822) and/or esters of ε-aminocaproic acid (CZ Pat. 276300) can be mentioned.

As used herein, the term „transdermal penetration enhancer“ refers to the substance(s) applicable in pharmaceutical preparations to increase penetration and permeation of drug(s) topically administered on human or animal skin with the aim of reaching therapeutically effective concentrations of drug(s) and other pharmacologically active agent(s) in deeper layers of the skin and/or adjacent tissues or for reaching effective concentrations of active agent(s) in systemic circulation of a living organism.

DETAILED DESCRIPTION OF THE INVENTION

The invention is directed to ω-Amino acid derivatives of the general formula (I)



$$R^1{-}\underset{\displaystyle X}{\underset{|}{CH}}{-}(CH_2)_n{-}COO{-}(CH_2)_m{-}Y$$

wherein R^1 is H, CH_3, X is H, NR^2R^3, where R^2 is H, CH_3, COH, $COCH_3$, R^3 is H, CH_3, $COO^- Z$, where Z is $R^2R^3\,NH^+CHR^1(CH_2)_nCOO(CH_2)_mCH_2Y$, where Y is H, CH_3, NHR^4, where R^4 is $COO^-NH_3^+CH_2(CH_2)_mOOC(CH_2)_nCH_3$, where the meaning of group $(CH_2\,)_m$ being selected from alkyls, secondary alkyls, monocycloalkyls, bicycloalkyls or tricycloalkyls having from 4 to 15 carbon atoms and n having a value of from 3 to 14.

The invention also relates to a method for the preparation of ω-amino acid derivatives of the general formula (I) characterised in that wherein an amino acid hydrochloride is reacted with thionyl chloride at a temperature of from 10 °C to 40 °C and the resulting aminoacylchloride hydrochloride is reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic and tricyclic alcohols in an aprotic medium at a temperature of from 20 °C to 90°C, giving rise to an amino acid ester hydrochloride which is then reacted with an amine in an aqueous or anhydrous medium, the basic ester being thereafter reacted with carbon dioxide.

The invention also relates to a method for the preparation of ω-amino acid derivatives of the general formula (I) characterised in that an acylamino acid is reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic and tricyclic alcohols at temperatures of from 0 °C to 40 °C in an anhydrous aprotic medium under the presence of a condensing agent. The condensing agent used is preferably dicyclohexylcarbodiimide or carbonyldiimidazole.

The invention also relates to a method for the preparation of ω-amino acid derivatives of the general formula (I) characterised in that an acylamido acid is reacted with thionyl chloride at a temperature of from 20 °C to 40 °C, the resulting acylaminoacyl chloride being reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic, and tricyclic alcohols in an aprotic medium at a temperature of from 20 °C to 90 °C.

The invention also relates to a method for the preparation of ω-amino acid derivatives of the general formula (I) characterised in that a carboxylic acid chloride is reacted with an α, ω-amino alcohol hydrochloride at a temperature of from 20 °C to 90 °C in an aprotic medium the amino ester hydrochloride being thereafter reacted with an amine in an aqueous or anhydrous medium and the basic amino ester being allowed to react with carbon dioxide.

The invention also relates to the use of the compounds of the general formula (I) as transdermal penetration enhancers in topical pharmaceutical and cosmetic preparations.
In more detail the invention relates to the use of these compounds as enhancers of transdermal penetration from the hydrophobic vehicle of a topical preparation in the amount from 0.1 to 5 w/w per cent, preferably from 0.5 to 2.5 w/w per cent or from a hydrophilic medium of a topical preparation in the amount from 0.1 to 5 w/w per cent, preferably from 0.5 to 1 w/w per cent.

Finally, the invention also relates to the transdermal penetration enhancers destined for enhancing the penetration of physiologically active substances applied topically to human or animal skin in order to produce therapeutically effective concentrations of the active substances in deeper layers of the skin or produce therapeutically effective concentrations of the active substances in the circulatory system of living organisms, consisting of at least one compound of the general formula (I).

The processes of preparation of compounds based on general formula (I) are described for selected substances in the Examples. These examples illustrate preparation of various types of new substances which are the subject of the invention. Substances synthesised by inventors are characterised in the pertinent Tables within the paragraph Examples.

The compounds of the general formula (I) are stable substances under the normal conditions. They can be easily prepared by simple laboratory procedures in small amounts as well as produced in large scale with high purity and large yield, which belongs among their advantages. Compounds based on ω-amino acids having the structure of general formula (I) are therefore relatively cheap.

Until now tested compounds of the general formula (I) have a very low oral toxicity and relatively low toxicity at intraperitoneous administration. For instance, when orally administered 8 g/kg of dodecyloxycarbonylpentylammonium dodecyloxycarbonylpentyl-carbamate (product No. 1.7) to a group of mice no mortality or significant changes in behaviour were observed. The value of LD_{50} of this substance after intraperitoneal administration was about 160 mg/kg of the weight of laboratory mice. In comparative tests of embryotoxicity carried out by the CHEST I method on chicken embryos it has been proved, for instance, that embryotoxic potential of the above mentioned compound according to the invention is one order lower comparing to N-decyl-2pyrrolidone and identical with 1-dodecylazacycloheptan-2-one (Azone®), that are as substances frequently used for transdermal penetration enhancement. Results of comparative experiments in which some other known agents were tested under the same conditions proved that embryotoxicity of above mentioned product No. 1.7 corresponds, for instance, to that of ketoprofen and ibuprofen. The compounds according to the invention tested so far are non-irritative when administered to skin and comply to the requirements of a pertinent paragraph of the Czechoslovak Pharmacopoeia 4, ed. 1987, (ČSL 4).

The advantage of practical use of compounds as enhancers according to the invention is that they are technologically easily incorporable with the majority of liquid or semi-solid vehicles commonly used in topical pharmaceutical or cosmetic preparation. These can be hydrophobic vehicles from the group of vegetable oils (e.g., sunflower oil, olive oil), synthetic liquid waxes (e.g., isopropyl myristate, isopropyl palmitate) or liquid paraffin, petrolatum, etc., or their mixtures as well as common hydrophillic vehicles (e.g., water, propylene glycol, glycerol, low molecular polyethylene glycoles) or their mixtures.

The advantage of using these compounds according to the invention as enhancers is that they are effective at relatively low concentrations in the range from 0.1 per cent to 5 per cent, preferably between 0.3 per cent to 2.5 per cent in relation to the total weight of the topical preparation.

It is known that many of permeation enhancers are effective with one drug but ineffective with other drug. That is why the inventors carried out *in vitro* permeation experiments to evaluate enhancing activity of chosen substances of the general formula (I). Among active agents belonging to therapeutically completely different groups that showed significant increase of skin penetration when using compounds according to the invention as enhancers of transdermal penetration, are polar drug (e.g., 5-fluorouracil), agents of medium polarity (e.g., aciclovir, flobufen, theophylline) as well as non-polar substance generally very hardly dissolving (e.g., griseofulvin).

Effectiveness of compounds according to the invention to enhance transdermal permeation was evaluated in *in vitro* finite dose, or flow out experiments on excised human skin, or *stratum corneum*, respectively, carried out under the conditions described in more details in paper by Doležal, P., Hrabálek, A., Semecký, V.: ε-Amino-caproic acid esters as transdermal penetration enhancing agents. Pharm. Res. 10, 1993, pp. 1015-1019, or Akhter, S.A., et al.: An automated diffusion apparatus for studying skin penetration. Int. J. Pharm., 21, 1984, pp. 17-26, respectively.

To express enhancing efficiency of compounds according to the invention, mean values of enhancement ratio, ER´s, as the ratios of the permeant flux ($\mu g/cm^2 . h^{-1}$) obtained by help donor samples containing enhancer tested comparing to the value of permeant flux for pertinent control samples (i.e. donor without the content of enhancer tested) were used.

For instance, some of the chosen results obtained by evaluation of the enhancement efficiancy with the use of product No.1.7 are as follows:

ER = 43.6 ± 11.5 for theophylline from aquaeous donor medium saturated with theophylline and with the content of 1 per cent of enhancer;

ER = 16.8 ± 5.8 for theophylline from the olive oil vehicle saturated by theophylline with the content of 1 per cent of enhancer;

ER = 4.2 ± 1.6 for flobufen from the medium of hydrophobic cream with the content of 5 per cent of flobufen and 2.5 per cent of enhancer;

EP = 24.7 ± 8.2 for griseofulvin from the mixture of propylene glycol and water (2:3) with the content of 0.1 per cent of griesofulvin and 2 per cent of enhancer;

EP = 7.8 ± 3.1 for aciclovir from propylene glycole with the content of 1 per cent of aciclovir and 1 per cent of enhancer;

EP = 88.0 ± 37 for 5-fluorouracil from aquaeous medium saurated by 5-fluorouracil with the content of 0.3 per cent of enhancer.

Within a set of screening *in vitro* experiments oriented to evaluation of transdermal enhancing efficiency of substances of general formula (I) that were synthetized by inventors. Theophylline was used as a model permeant.

EXAMPLES

Example 1

Hexyloxykarbonylpentylammonium hexyloxykarbonylpentylcarbamate
6-aminohexanoic acid hydrochloride (0.1 mol) was treated with thionyl chloride (0.2 mol) at 35 °C until the mixture became homogeneous. The excess thionyl chloride was then removed under reduced pressure, a solution of hexanol (0.1 mol) in dry $CHCl_3$ (100 ml) was added to the residue, and the resultant mixture was heated at reflux. After 1 hour at reflux, chloroform was evaporated under reduced pressure, the residue was dried, and by-product hydrogen chloride removed. The crude compound was dissolved in water, triethyl amine (0.15 mol) was added to the solution, and the resultant mixture was extracted with diethyl ether. The ethereal phase was dried over anhydrous Na_2SO_4, solvent evaporated, and the crude product was allowed to stir in a CO_2 atmosphere for 1 hour. Traces of triethyl amine were removed upon standing over a vessel containing sulfuric acid under vacuum, and the product crystallised from toluene.

Example 2

2-Octyl-6-aminohexanoate
6-aminohexanoic acid hydrochloride (0.1 mol) was treated with thionyl chloride (0.2 mol) at 35 °C until the mixture became homogeneous. The excess thionyl chloride was then removed under reduced pressure, a solution of 2-octanol (0.09 mol) in dry $CHCl_3$ (100 ml) was added to the residue, and the resultant mixture was heated at reflux. After 2 hours at reflux, chloroform was evaporated under reduced pressure, the residue was dried, and by-product hydrogen chloride removed. The crude compound was dissolved in water, triethyl amine (0.15 mol) was added to the solution. The resultant mixture was extracted with toluene, the organic phase dried over anhydrous Na_2SO_4, solvent removed, and the product purified on a microcrystalline cellulose column using toluene as the mobile phase. The purity of the product was monitored by TLC on cellulose; the compound obtained was chromatographically homogeneous.

Example 3

Cyclododecyloxycarbonylpentylammonium cyclododecyloxycarbonylpentylcarbamate
6-aminohexanoic acid hydrochloride (0.1 mol) was treated with thionyl chloride (0.2 mol) at 40°C until the mixture became homogeneous. The excess thionyl chloride was then removed under reduced pressure, a solution of cyclododekanol (0.1 mol) in dry dimethyl formamide (100 ml) was added to the residue, and the resultant mixture was heated at 90 °C. After 1 hour at this temperature, the solvent was evaporated under reduced pressure, the residue was dried, and by-product hydrogen chloride removed. The crude compound was dissolved in water, triethyl amine (0.15 mol) was added to the solution, and the resultant mixture was extracted with diethyl ether. The ethereal phase was dried over anhydrous Na_2SO_4, solvent evaporated, and the crude product was allowed to stir in a CO_2 atmosphere for 1 hour. Traces of triethyl amine were removed upon standing over a vessel containing sulfuric acid under vacuum, and the product crystallised from toluene.

Example 4

1-Decyl-5-acetamidopentanoate
Acetamidopentanoic acid (0.01 mol), and dekanol (0.01 mol) were suspended in dry diethyl ether (50 ml). A solution of dicyclohexylcarbodiimide (0.01 mol) in dry diethyl ether (50 ml) was added to the suspension upon stirring, and the resultant mixture was further stirred at ambient temperature for 12 hours. The precipitate of dicyclohexylurea was then removed by filtration, and the solution concentrated. The product was crystallised from ethyl acetate/petrolether mixture.

Example 5

4-Nonyl-8-acetamidooctanoate
Acetamidooctanoic acid (0.01 mol), 4-nonanol (0.01 mol), and pyrrolidinopyridine (0.001 mol) were suspended in dry diethyl ether (50 ml). A solution of dicyclohexylcarbodiimide (0.01 mol) in dry diethyl ether (50 ml) was added to the suspension upon stirring, and the resultant mixture was further stirred at ambient temperature for 12 hours. Acetic acid (0.2 ml) was then added, the precipitate of dicyclohexylurea was removed by filtration, and the solution concentrated. The resultant oil was purified on a microcrystalline cellulose column using ethyl acetate as the mobile phase. The purity of the product was monitored by TLC on cellulose; the compound obtained was chromatographically homogeneous.

Example 6

Hexadecanoyloxyhexylammonium hexadecanoyloxyhexylcarbamate
Hexadecanoic acid (0.01 mol) was treated with thionyl chloride (0.15 mol) in dry toluene (100 ml) at reflux. After 1 hour at reflux, the solvent and the excess reagent were removed under reduced pressure, a suspension of 1,6-aminohexanol hydrochloride (0.01 mol) in dry chloroform was added to the residue, and the reaction mixture was heated at 64°C until it became homogeneous. After cooling to ambient temperature, the solution was concentrated, the aminoester hydrochloride was crystallised from ethanol/diethyl ether mixture, and subjected to reaction with with triethyl amine in an aqueous solution. Following the separation/drying/solvent removal cycle, the crude product was allowed to stir in a CO_2 atmosphere for 1 hour. Traces of triethyl amine were removed upon standing over a vessel containing sulfuric acid under vacuum, and the product crystallised from toluene.

On the basis of the method according to Example 1 thirty one of new substances were synthetised where 6-aminohexanoic acid hydrochloride (within the first group), 7-aminoheptanoic acid hydrochloride (within the second group), and, 8-aminooctanoic acid hydrochloride (within the third group) as starting substances were used. These 31 substances are presented in Table I. The physicochemical characteristics of these substances are summarised in Table IX and Table XXII, respectively, and selected efficiency data are presented in Table XXVI.

Table I: Carbamates based on the primary alkyl aminoalkanoates

Starting ω-aminoacid	Starting alcohol	Product No.	Product
6-Aminohexanoic acid	1-Hexanol	1.1	Hexyloxycarbonylpentylammonium hexyloxycarbonylpentylcarbamate
	1-Heptanol	1.2	Heptyloxycarbonylpentylammonium heptyloxycarbonylpentylcarbamate
	1-Octanol	1.3	Octyloxycarbonylpentylammonium octyloxycarbonylpentylcarbamate
	1-Nonanol	1.4	Nonyloxycarbonylpentylammonium nonyloxycarbonylpentylcarbamate
	1-Decanol	1.5	Decyloxycarbonylpentylammonium decyloxycarbonylpentylcarbamate
	1-Undecanol	1.6	Undecyloxycarbonylpentylammonium undecyloxycarbonylpentylcarbamate
	1-Dodecanol	1.7	Dodecyloxycarbonylpentylammonium dodecyloxycarbonylpentylcarbamate
	1-Tetradecanol	1.8	Tetradecyloxycarbonylpentylammonium tetradecyloxycarbonylpentylcarbamate
	1-Hexadecanol	1.9	Hexadecyloxycarbonylpentylammonium hexadecyloxycarbonylpentylcarbamate
7-Aminoheptanoic acid	1-Pentanol	1.10	Pentyloxycarbonylhexylammonium pentyloxycarbonylhexylcarbamate
	1-Hexanol	1.11	Hexyloxycarbonylhexylammonium hexyloxycarbonylhexylcarbamate
	1-Heptanol	1.12	Heptyloxycarbonylhexylammonium heptyloxycarbonylhexylcarbamate
	1-Octanol	1.13	Octyloxycarbonylhexylammonium octyloxycarbonylhexylcarbamate
	1-Nonanol	1.14	Nonyloxycarbonylhexylammonium nonyloxycarbonylhexylcarbamate
	1-Decanol	1.15	Decyloxycarbonylhexylammonium decyloxycarbonylhexylcarbamate
	1-Undecanol	1.16	Undecyloxycarbonylhexylammonium undecyloxycarbonylhexylcarbamate
	1-Dodecanol	1.17	Dodecyloxycarbonylhexylammonium dodecyloxycarbonylhexylcarbamate
	1-Tetradecanol	1.18	Tetradecyloxycarbonylhexylammonium tetradecyloxycarbonylhexylcarbamate
	1-Hexadecanol	1.19	Hexadecyloxycarbonylhexylammonium hexadecyloxycarbonylhexylcarbamate

Table I: Carbamates based on the primary alkyl aminoalkanoates (continued)

Starting ω-aminoacid	Starting alcohol	Product No.	Product
8-Aminooctanoic acid	1-Pentanol	1.20	Pentyloxycarbonylheptylammonium pentyloxycarbonylheptylcarbamate
	1-Hexanol	1.21	Hexyloxycarbonylhexylammonium hexyloxycarbonylhexylcarbamate
	1-Heptanol	1.22	Heptyloxycarbonylhexylammonium heptyloxycarbonylhexylcarbamate
	1-Octanol	1.23	Octyloxycarbonylhexylammonium octyloxycarbonylhexylcarbamate
	1-Nonanol	1.24	Nonyloxycarbonylhexylammonium nonyloxycarbonylhexylcarbamate
	1-Decanol	1.25	Decyloxycarbonylhexylammonium decyloxycarbonylhexylcarbamate
	1-Undecanol	1.26	Undecyloxycarbonylhexylammonium undecyloxycarbonylhexylcarbamate
	1-Dodecanol	1.27	Dodecyloxycarbonylhexylammonium dodecyloxycarbonylhexylcarbamate
	1-Tetradecanol	1.28	Tetradecyloxycarbonylhexylammonium tetradecyloxycarbonylhexylcarbamate
	1-Hexadecanol	1.29	Hexadecyloxycarbonylhexylammonium hexadecyloxycarbonylhexylcarbamate
6-Methylaminohexanoic acid	1-Undecanol	1.30	Undecyloxycarbonylpentylmethylammonium undecyloxycarbonylpentylmethylylcarbamate
	1-Dodecanol	1.31	Dodecyloxycarbonylpentylmethylammonium dodecyloxycarbonylpentylmethylylcarbamate

On the basis of the method according to Example 2 thirty nine of new substances were synthetised where 6-aminohexanoic acid hydrochloride (within the first group), 7-aminoheptanoic acid hydrochloride (within the second group), and, 8-aminooctanoic acid hydrochloride (within the third group) as starting substances were used. These 39 substances are presented in Table II. The physicochemical characteristics of these substances are summarised in Table X and Table XVII, respectively, and selected efficiency data are presented in Table XXVI.

Table II: Secondary alkyl-ω-aminoalkanoates

Starting ω-amino acid	Starting alcohol	Product No.	Product No.
6-aminohexanoic acid	2-Heptanol	2.1	2-Heptyl 6-aminohexanoate
	3-Heptanol	2.2	3-Heptyl 6-aminohexanoate
	4-Heptanol	2.3	4-Heptyl 6-aminohexanoate
	2-Octanol	2.4	2-Octyl 6-aminohexanoate
	3-Octanol	2.5	3-Octyl 6-aminohexanoate
	2-Nonanol	2.6	2-Nonyl 6-aminohexanoate
	3-Nonanol	2.7	3-Nonyl 6-aminohexanoate
	4-Nonanol	2.8	4-Nonyl 6-aminohexanoate
	5-Nonanol	2.9	5-Nonyl 6-aminohexanoate
	2-Decanol	2.10	2-Decyl 6-aminohexanoate
	2-Undecanol	2.11	2-Undecyl 6-aminohexanoate
	2-Dodecanol	2.12	2-Dodecyl 6-aminohexanoate
	7-Tetradecanol	2.13	7-Tetradecyl 6-aminohexanoate
7-aminoheptanoic acid	2-Heptanol	2.14	2-Heptyl 7-aminoheptanoate
	3-Heptanol	2.15	3-Heptyl 7-aminoheptanoate
	4-Heptanol	2.16	4-Heptyl 7-aminoheptanoate
	2-Octanol	2.17	2-Octyl 7-aminoheptanoate
	3-Octanol	2.18	3-Octyl 7-aminoheptanoate
	2-Nonanol	2.19	2-Nonyl 7-aminoheptanoate
	3-Nonanol	2.20	3-Nonyl 7-aminoheptanoate
	4-Nonanol	2.21	4-Nonyl 7-aminoheptanoate
	5-Nonanol	2.22	5-Nonyl 7-aminoheptanoate
	2-Decanol	2.23	2-Decyl 7-aminoheptanoate
	2-Undecanol	2.24	2-Undecyl 7-aminoheptanoate
	2-Dodecanol	2.25	2-Dodecyl 7-aminoheptanoate
	7-Tetradecanol	2.26	7-Tetradecyl 7-aminoheptanoate
8-aminooctanoic acid	2-Heptanol	2.27	2-Heptyl 8-aminooctanoate
	3-Heptanol	2.28	3-Heptyl 8-aminooctanoate
	4-Heptanol	2.29	4-Heptyl 8-aminooctanoate
	2-Octanol	2.30	2-Octyl 8-aminooctanoate
	3-Octanol	2.31	3-Octyl 8-aminooctanoate
	2-Nonanol	2.32	2-Nonyl 8-aminooctanoate
	3-Nonanol	2.33	3-Nonyl 8-aminooctanoate
	4-Nonanol	2.34	4-Nonyl 8-aminooctanoate
	5-Nonanol	2.35	5-Nonyl 8-aminooctanoate
	2-Decanol	2.36	2-Decyl 8-aminooctanoate
	2-Undecanol	2.37	2-Undecyl 8-aminooctanoate
	2-Dodecanol	2.38	2-Dodecyl 8-aminooctanoate
	7-Tetradecanol	2.39	7-Tetradecyl 8-aminooctanoate

On the basis of the method according to Example 2 eight of new substances were synthetised where 6-methylaminohexanoic acid hydrochloride (within the first group), and, 8-aminooctanoic acid hydrochloride (within the second group) as starting substances were used. These 8 substances are presented in Table III. The physicoche mical characteristics of these substances are summarised in Table XI and Table XVIII, respectively, and selected efficiency data are presented in Table XXVI.

Table III: Primary alkyl 6-methyl- and 6-dimethylaminohexanoates

Starting ω-amino acid	Starting alcohol	Product No.	Product No.
6-Methylaminohexanoic acid	1-Octanol	3.1	Octyl 6-methylaminohexanoate
	1-Nonanol	3.2	Nonyl 6-methylaminohexanoate
	1-Decanol	3.3	Decyl 6-methylaminohexanoate
6-Dimethylaminohexanoic acid	1-Octanol	3.4	Octyl 6-dimethylaminohexanoate
	1-Nonanol	3.5	Nonyl 6-dimethylaminohexanoate
	1-Decanol	3.6	Decyl 6-dimethylaminohexanoate
	1-Undecanol	3.7	Undecyl 6-dimethylaminohexanoate
	1-Dodecanol	3.8	Dodecyl 6-dimethylaminohexanoate

On the basis of the method according to Example 3 nine of new substances were synthetised where 6-aminohexanoic acid hydrochloride (within the first group), 7-aminoheptanoic acid hydrochloride (within the second group), and, 8-aminooctanoic acid hydrochloride (within the third group) as starting substances were used. These 9 substances are presented in Table IV. The physicochemical characteristics of these substances are summarised in Table XIII and Table XXIII, respectively, and selected efficiency data are presented in Table XXVI.

Table IV: Carbamates based on the cycloalkyl ω-aminoalkanoates)

Starting ω-aminoacid	Starting alcohol	Product No.	Product
6-Aminohexanoic acid	Cyclododecanol	4.1	Cyclododecyloxycarbonylpentylammonium cyclododecyloxycarbonylpentylcarbamate
	2-Indanol	4.2	2-Indanyloxycarbonylpentylammonium 2-indanyloxycarbonylpentylcarbamate
	1-Adamantanol	4.3	1-Adamantyloxycarbonylpentylammonium 1-adamantyloxycarbonylpentylcarbamate
7-Aminoheptanoic acid	Cyclododecanol	4.4	Cyclododecyloxycarbonylhexylammonium cyclododecyloxycarbonylhexylcarbamate
	2-Indanol	4.5	2-Indanyloxycarbonylhexylammonium 2-indanyloxycarbonylhexylcarbamate
	1-Adamantanol	4.6	1-Adamantyloxycarbonylhexylammonium 1-adamantyloxycarbonylhexylcarbamate
8-Aminooctanoic acid	Cyclododecanol	4.7	Cyclododecyloxycarbonylheptylammonium cyclododecyloxycarbonylheptylcarbamate
	2-Indanol	4.8	2-Indanyloxycarbonylheptylammonium 2-indanyloxycarbonylheptylcarbamate
	1-Adamantanol	4.9	1-Adamantyloxycarbonylheptylammonium 1-adamantyloxycarbonylheptylcarbamate

On the basis of the method according to Example 2 nine of new substances were synthetised where 6-aminohexanoic acid hydrochloride (within the first group), 7-aminoheptanoic acid hydrochloride (within the second group), and, 8-aminooctanoic acid hydrochloride (within the third group) as starting substances were used. These 9 substances are presented in Table V. The physicochemical characteristics of these substances are summarised in Table XII and Table XVIX, respectively, and selected efficiency data are presented in Table XXVI.

Table V: Cycloalkyl ω-aminoalkanoates

Starting ω-amino acid	Starting alcohol	Product No.	Product
6-Aminohexanoic acid	Cyclopentanol	5.1	Cyclopentyl 6-amino hexanoate
	Cyclohexanol	5.2	Cyclohexyl 6-amino hexanoate
	Cycloheptanol	5.3	Cycloheptyl 6-amino hexanoate
	Cyclooctanol	5.4	Cyclooctyl 6-amino hexanoate
7-Aminoheptanoic acid	Cyclohexanol	5.5	Cyclohexyl 7-amino heptanoate
	Cycloheptanol	5.6	Cycloheptyl 7-amino heptanoate
	Cyclooctanol	5.7	Cyclooctyl 7-amino heptanoate
8-Aminooctanoic acid	Cycloheptanol	5.8	Cycloheptyl 8-amino octanoate
	Cyclooctanol	5.9	Cyclooctyl 8-amino octanoate

On the basis of the method according to Example 4 twenty three of new substances were synthetised where 5-acetylaminopentanoic acid (within the first group), 6-acetylaminohexanoic acid (within the second group), 7-acetylaminoheptanoic acid and (within the third group), and 8-aminooctanoic acid hydrochloride (within the fourth group) as starting substances were used. These 23 substances are presented in Table VI. The physicochemical characteristics of these substances are summarised in Table XV, Table XX, and Table XXIV respectively, and selected efficiency data are presented in Table XXVI.

Table VI : Primary alkyl ω-acetylaminoalkanoates

Starting ω-acetylamino acid	Starting alcohol	Product No.	Product
5-Acetylaminopentanoic acid	1-Octanol	6.1	Octyl 5-acetylaminopentanoate
	1-Nonanol	6.2	Nonyl 5-acetylaminopentanoate
	1-Decanol	6.3	Decyl 5-acetylaminopentanoate
	1-Undecanol	6.4	Undecyl 5-acetylaminopentanoate
	1-Dodecanol	6.5	Dodecyl 5-acetylaminopentanoate
6-Acetylaminohexanoic acid	1-Hexanol	6.6	Hexyl 6-acetylaminohexanoate
	1-Heptanol	6.7	Heptyl 6-acetylaminohexanoate
	1-Octanol	6.8	Octyl 6-acetylaminohexanoate
	1-Nonanol	6.9	Nonyl 6-acetylaminohexanoate
	1-Decanol	6.10	Decyl 6-acetylaminohexanoate
	1-Undecanol	6.11	Undecyl 6-acetylaminohexanoate
	1-Dodecanol	6.12	Dodecyl 6-acetylaminohexanoate
7-Acetylaminoheptanoic acid	1-Pentanol	6.13	Pentyl 7-acetylaminohexanoate
	1-Heptanol	6.14	Heptyl 7-acetylaminohexanoate
	1-Octanol	6.15	Octyl 7-acetylaminohexanoate
	1-Nonanol	6.16	Nonyl 7-acetylaminohexanoate
	1-Decanol	6.17	Decyl 7-acetylaminohexanoate
	1-Undecanol	6.18	Undecyl 7-acetylaminohexanoate
	1-Dodecanol	6.19	Dodecyl 7-acetylaminohexanoate
8-Acetylaminooctanoic acid	1-Pentanol	6.20	Pentyl 8-acetylaminooctanoate
	1-Octanol	6.21	Octyl 8-acetylaminooctanoate
	1-Decanol	6.22	Decyl 8-acetylaminooctanoate
	1-Dodecanol	6.23	Dodecyl 8-acetylaminooctanoate

On the basis of the method according to Example 5 thirty seven of new substances were synthetised where 5-acetylaminopentanoic acid (within the first group), 6-acetylaminohexanoic acid (within the second group), 7-acetylaminoheptanoic acid and (within the third group), and 8-aminooctanoic acid hydrochloride (within the fourth group) as starting substances were used. These 37 substances are presented in Table VII. The physicochemical characteristics of these substances are summarised in Table XVI, Table XXI, respectively, and selected efficiency data are presented in Table XXVI.

Table VII: Secondary alkyl ω-acetaminoalkanoates

Starting ω-acetylamino acid	Starting alcohol	Product No.	Product
5-Acetylaminopentanoic acid	2-Heptanol	7.1	2-Heptyl 5-acetylaminopentanoate
	3-Heptanol	7.2	3-Heptyl 5-acetylaminopentanoate
	2-0ctanol	7.3	2-Octyl 5-acetylaminopentanoate
	2-Nonanol	7.4	2-Nonyl 5-acetylaminopentanoate
	3-Nonanol	7.5	3-Nonyl 5-acetylaminopentanoate
	2-Decanol	7.6	2-Decyl 5-acetylaminopentanoate
6-Acetylaminohexanoic acid	2-Heptanol	7.7	2-Heptyl 6-acetylaminohexanoate
	4-Heptanol	7.8	4-Heptyl 6-acetylaminohexanoate
	2-Octanol	7.9	2-Octyl 6-acetylaminohexanoate
	3-Octanol	7.10	3-Octyl 6-acetylaminohexanoate
	4-Nonanol	7.11	4-Nonyl 6-acetylaminohexanoate
	5-Nonanol	7.12	5-Nonyl 6-acetylaminohexanoate
	2-Decanol	7.13	2-Decyl 6-acetylaminohexanoate
	2-Undecanol	7.14	2-Undecyl 6-acetylaminohexanoate
	7-Tetradecanol	7.15	7-Tetradecyl 6-acetylaminohexanoate
7-Acetylaminoheptanoic acid	2-Heptanol	7.16	2-Heptyl 7-acetylaminoheptanoate
	3-Heptanol	7.17	3-Heptyl 7-acetylaminoheptanoate
	4-Heptanol	7.18	4-Heptyl 7-acetylaminoheptanoate
	2-Octanol	7.19	2-Octyl 7-acetylaminoheptanoate
	3-Octanol	7.20	3-Octyl 7-acetylaminoheptanoate
	2-Nonanol	7.21	2-Nonyl 7-acetylaminoheptanoate
	3-Nonanol	7.22	3-Nonyl 7-acetylaminoheptanoate
	4-Nonanol	7.23	4-Nonyl 7-acetylaminoheptanoate
	5-Nonanol	7.24	5-Nonyl 7-acetylaminoheptanoate
	2-Decanol	7.25	2-Decyl 7-acetylaminoheptanoate
	2-Undecanol	7.26	2-Undecyl 7-acetylaminoheptanoate
8-Acetylaminooctanoic acid	2-Heptanol	7.27	2-Heptyl 8-aminoacetyloctanoate
	3-Heptanol	7.28	3-Heptyl 8-aminoacetyloctanoate
	4-Heptanol	7.29	4-Heptyl 8-aminoacetyloctanoate
	2-Octanol	7.30	2-Octyl 8-aminoacetyloctanoate
	3-Octanol	7.31	3-Octyl 8-aminoacetyloctanoate
	2-Nonanol	7.32	2-Nonyl 8-aminoacetyloctanoate
	3-Nonanol	7.33	3-Nonyl 8-aminoacetyloctanoate
	4-Nonanol	7.34	4-Nonyl 8-aminoacetyloctanoate
	5-Nonanol	7.35	5-Nonyl 8-aminoacetyloctanoate
	2-Decanol	7.36	2-Decyl 8-aminoacetyloctanoate
	2-Undecanol	7.37	2-Undecyl 8-aminoacetyloctanoate

On the basis of the method according to Example 6 ten of new substances were synthetised where 6-amino-1-hexanol (within the first group), 5-amino-1-pentanol (within the second group) as starting substances were used. These 10 substances are presented in Table VIII. The physicochemical characteristics of these substances are summarised in Table XIV and Table XXV, respectively, and selected efficiency data are presented in Table XXVI.

Table VIII: Carbamates based on the ω-aminoalkyl alkanoates

α,ω-amino alcohol	Carboxylic acid	Product No.	Product
6-Amino-1-hexanol	Octanoic acid	8.1	Octylcarbonyloxypentylammonium octylcarbonyloxypentylcarbamate
	Nonanoic acid	8.2	Nonylcarbonyloxypentylammonium nonylcarbonyloxypentylcarbamate
	Decanoic acid	8.3	Decylcarbonyloxypentylammonium decylcarbonyloxypentylcarbamate
	Undecanoic acid	8.4	Undecylcarbonyloxypentylammonium undecylcarbonyloxypentylcarbamate
	Dodecanoic acid	8.5	Dodecylcarbonyloxypentylammonium dodecylcarbonyloxypentylcarbamate
5-Amino-1-pentanol	Octanoic acid	8.6	Octylcarbonyloxybutylammonium octylcarbonyloxybutylcarbamate
	Nonanoic acid	8.7	Nonylcarbonyloxybutylammonium nonylcarbonyloxybutylcarbamate
	Decanoic acid	8.8	Decylcarbonyloxybutylammonium decylcarbonyloxybutylcarbamate
	Undecanoic acid	8.9	Undecylcarbonyloxybutylammonium undecylcarbonyloxybutylcarbamate
	Dodecanoic acid	8.10	Dodecylcarbonyloxybutylammonium dodecylcarbonyloxybutylcarbamate

Table IX: Melting point [°C] and IR spectra of carbamates based on the primary alkyl ω-aminoalkanoates (measured in KBr) [cm^{-1}]

Product No.	νNH	ν_aCH$_3$	ν_aCH$_2$	ν_sCH$_2$	νCO esters	νCO carbamates	δCH$_2$	δCH$_3$	ν_aCOC	ρCH$_2$	M.P. [°C]
1.1	3431; 3355	2953	2919	2850	1734	1617	1468	1377	1194	721	45 - 47
1.2	3430; 3355	2953	2919	2850	1735	1617	1468	1377	1194	720	49 - 50
1.3	3433; 3355	2951	2919	2850	1735	1617	1468	1377	1194	719	51 -54
1.4	3428; 3354	2953	2919	2850	1733	1616	1468	1377	1194	720	53 - 55
1.5	3432; 3355	2949	2919	2850	1735	1617	1468	1377	1193	720	56 - 57
1.6	3432; 3355	2953	2920	2850	1735	1618	1468	1377	1194	720	58 - 60
1.7	3430; 3355	2953	2919	2850	1735	1617	1468	1377	1194	720	61 - 64
1.8	3432; 3355	2952	2919	2849	1735	1617	1468	1377	1194	722	68 - 71
1.9	3432; 3365	2955	2918	2850	1735	1617	1468	1376	1194	720	86 - 90
1.10	3430; 3355	2955	2920	2850	1734	1616	1468	1380	1194	720	36 - 40
1.11	3430; 3350	2955	2920	2850	1734	1617	1468	1380	1194	720	38 - 41
1.12	3430; 3355	2955	2920	2850	1735	1617	1468	1380	1194	722	40 - 43
1.13	3430; 3355	2953	2919	2850	1735	1617	1468	1380	1194	720	42 - 45
1.14	3430; 3352	2953	2920	2850	1733	1616	1468	1380	1194	722	44 - 47
1.15	3430; 3355	2953	2920	2850	1733	1616	1468	1380	1194	722	46 - 49
1.16	3430; 3352	2953	2918	2850	1733	1616	1469	1380	1194	720	48 - 51
1.17	3435; 3353	2956	2919	2850	1734	1618	1468	1380	1194	720	50 - 53
1.18	3430; 3352	2950	2920	2850	1735	1616	1468	1380	1194	720	54 - 57
1.19	3430; 3352	2953	2921	2850	1730	1616	1468	1380	1194	722	58 - 61
1.20	3435; 3355	2950	2919	2850	1733	1616	1468	1378	1194	718	31 - 34
1.21	3430; 3350	2952	2920	2850	1735	1618	1466	1380	1194	720	33 - 37
1.22	3430; 3352	2953	2920	2850	1730	1620	1468	1377	1194	722	36 - 40
1.23	3434; 3353	2953	2920	2848	1736	1618	1468	1376	1194	720	38 -41
1.24	3430; 3350	2953	2922	2850	1733	1616	1469	1380	1194	718	41 - 44
1.25	3430; 3355	2949	2920	2852	1734	1619	1468	1380	1194	722	43 - 47
1.26	3430; 3352	2953	2920	2850	1733	1616	1468	1380	1194	722	46 - 49

Table IX: Melting point [°C] and IR spectra of carbamates based on the primary alkyl ω-aminoalkanoates (measured in KBr) [cm $^{-1}$] (continued)

Product No.	νNH	$\nu_a CH_3$	$\nu_a CH_2$	$\nu_s CH_2$	νCO esters	νCO carbamates	δCH_2	δCH_3	ν_aCOC	ρCH_2	M.P. [°C]
1.27	3428; 3352	2955	2922	2850	1730	1620	1467	1378	1192	719	50 - 52
1.28	3430; 3355	2950	2918	2848	1735	1616	1468	1380	1194	722	56 - 59
1.29	3430; 3350	2953	2920	2850	1735	1618	1468	1377	1194	723	58 - 61
1.30		2993	2950	2845	1736	1612	1467	1384	1196	720	28 - 35
1.31		2995	2952	2843	1734	1610	1468	1386	1194	720	32 - 37

Table X: Melting point [°C] and IR spectra of secondary alkyl ω-aminoalkanoates (measured in $CHCl_3$) [cm^{-1}]

Product No.	$\nu_a CH_3$	$\nu_a CH_2$	$\nu_s CH_3$	$\nu_s CH_2$	νCO	δCH_2	δCH_3	M P. [°C]
2.1	2982	2968	2850	2820	1720	1468	1378	oil
2.2	2990	2982	2850	2820	1721	1468	1376	oil
2.3	2993	2980	2853	2820	1720	1468	1376	oil
2.4	2955	2918	2850	2820	1720	1468	1376	oil
2.5	2965	2923	2850	2820	1720	1468	1376	oil
2.6	2984	2945	2850	2820	1722	1468	1376	oil
2.7	2965	2932	2850	2826	1723	1468	1378	oil
2.8	2972	2922	2850	2820	1722	1465	1379	oil
2.9	2958	2918	2850	2820	1720	1468	1375	oil
2.10	2965	2918	2850	2820	1722	1468	1373	oil
2.11	2958	2919	2850	2820	1721	1465	1379	oil
2.12	2950	2920	2850	2820	1720	1468	1376	oil
2.13	2950	2920	2850	2825	1720	1468	1380	oil
2.14	2958	2920	2850	2820	1720	1468	1378	oil
2.15	2956	2920	2850	2824	1720	1467	1375	oil
2.16	2958	2920	2848	2820	1722	1468	1378	oil
2.17	2958	2922	2850	2818	1720	1468	1377	oil
2.18	2958	2920	2850	2820	1720	1468	1378	oil
2.19	2962	2924	2855	2820	1719	1467	1378	oil
2.20	2956	2920	2850	2824	1720	1468	1380	oil
2.21	2966	2920	2850	2820	1725	1468	1378	oil
2.22	2958	2924	2850	2818	1720	1469	1378	oil
2.23	2954	2920	2848	2820	1726	1468	1378	oil
2.24	2958	2920	2850	2820	1720	1468	1378	oil
2.25	2959	2920	2853	2825	1723	1468	1378	oil
2.26	2958	2918	2850	2820	1720	1466	1375	oil
2.27	2956	2920	2850	2819	1720	1468	1378	oil
2.28	2962	2920	2853	2820	1723	1468	1377	oil
2.29	2960	2920	2850	2820	1724	1468	1378	oil
2.30	2955	2922	2854	2826	1720	1465	1378	oil
2.31	2959	2920	2853	2820	1722	1468	1377	oil
2.32	2954	2920	2852	2825	1720	1468	1378	oil
2.33	2956	2926	2855	2820	1720	1464	1378	oil
2.34	2959	2920	2850	2820	1725	1468	1380	oil
2.35	2958	2920	2848	2818	1720	1468	1378	oil
2.36	2963	2925	2853	2821	1722	1470	1378	oil
2.37	2958	2920	2850	2818	1720	1468	1375	oil
2.38	2956	2924	2847	2825	1726	1468	1378	oil
2.39	2958	2920	2850	2820	1720	1464	1378	oil

Table XI: Melting point [°C] and IR spectra of the primary alkyl 6-methyl- and 6-dimethylaminohexanoates (measured in $CHCl_3$) [cm $^{-1}$]

Product No.	ν_aCH_2	ν_sCH_3	ν_sCH_2	νCO	δCH_2	δCH_3	M.P. [°C]
3.1	2931	2857	2801	1725	1467	1375	oil
3.2	2931	2857	2801	1725	1467	1376	oil
3.3	2929	2857	2801	1725	1467	1378	oil
3.4	2932	2860	2822	1725	1467	1377	oil
3.5	2931	2860	2822	1725	1467	1376	oil
3.6	2930	2859	2823	1725	1467	1376	oil
3.7	2929	2858	2823	1725	1467	1376	oil
3.8	2929	2858	2823	1725	1467	1376	oil

Table XII: Melting point [°C] and IR spectra of the cycloalkyl ω-aminoalkanoates (measured in $CHCl_3$) [cm $^{-1}$]

Product No.	ν_aCH_2	ν_sCH_2	νCO	δCH_2	νCOC	M.P. [°C]
5.1	2950	2870	1710	1468	1270; 1205	oil
5.2	2960	2880	1710	1468	1250; 1205	oil
5.3	2950	2880	1710	1468	1270, 1205	oil
5.4	2950	2870	1710	1468	1270, 1205	oil
5.5	2950	2875	1710	1468	1260, 1205	oil
5.6	2950	2870	1710	1468	1270, 1205	oil
5.7	2950	2870	1710	1468	1270, 1205	oil
5.8	2950	2875	1710	1468	1270, 1210	oil
5.9	2950	2870	1710	1468	1270, 1205	oil

Table XIII: Melting point [°C] and IR spectra of the carbamates based on the cycloalkyl ω-aminoalkanoates (measured in KBr) [cm $^{-1}$]

Product No.	νNH	ν_aCH_2	ν_sCH_2	νCO esters	νCO carbamates	δCH_2	ν_aCOC	ρCH_2	M.P. [°C]
4.1	3430; 3363	2920	2848	1734	1617	1468	1194	721	50 - 55
4.2	3430; 3363; 3112	2920	2848	1735	1615	1468	1194	720	76 - 80
4.3	3443; 3342		2848	1735	1615	1468	1194	721	15 - 20
4.4	3430; 3363	2918	2848	1736	1617	1468	1194	720	47 - 52
4.5	3430; 3363; 3112	2920	2848	1735	1617	1467	1194	720	71 - 75
4.6	3443; 3342		2850	1735	1615	1468	1194	721	17 - 22
4.7	3430; 3363	2920	2849	1735	1619	1468	1194	721	43 - 48
4.8	3430; 3363; 3110	2920	2848	1737	1617	1467	1194	722	68 - 72
4.9	3430; 3342		2850	1735	1617	1468	1194	720	20 - 25

Table XIV: Melting point [°C] and IR spectra of the carbamates based on the ω-aminoalkyl alkanoates (measured in KBr) [cm $^{-1}$]

Product No.	νNH	ν_aCH_3	ν_aCH_2	νCO esters	νCO carbamates	δCH_2	δCH_3	ν_aCOC	ρCH_2	M.P. [°C]
8.1	3430; 3346	2995	2955	1735	1617	1468	1376	1194	720	46 - 50
8.2	3430; 3352	2995	2955	1735	1620	1468	1377	1194	720	51 - 54
8.3	3433; 3350	2992	2945	1734	1617	1468	1377	1194	719	55 - 59
8.4	3428; 3348	2995	2955	1733	1616	1468	1378	1194	720	64 - 66
8.5	3432; 3350	2995	2960	1735	1617	1467	1377	1193	720	65 - 68
8.6	3432; 3346	2990	2955	1736	1618	1468	1376	1194	720	63 - 65
8.7	3430; 3346	2995	2955	1735	1617	1468	1377	1194	720	60 - 62
8.8	3432; 3350	2995	2950	1735	1617	1468	1377	1195	722	58 - 59
8.9	3428; 3365	2995	2955	1735	1617	1468	1376	1194	720	55 - 57
8.10	3430; 3355	2994	2955	1734	1616	1468	1380	1194	722	52 - 54

Table XV: Melting point [°C] and IR spectra of the primary alkyl ω-acetylaminoalkanoates (measured in KBr) [cm $^{-1}$]

Product No.	νNH	ν_aCH_3	ν_aCH_2	νCO ester	νCO amide	δNH amide	νCOC	M.P. [°C]
6.1	3450	2980	2950	1735	1665	1520	1185; 1250	34 - 37
6.2	3455	2980	2950	1735	1665	1520	1187; 1250	36 - 40
6.3	3450	2980	2955	1734	1665	1520	1185; 1250	38 - 42
6.4	3450	2980	2950	1735	1668	1525	1180; 1250	40 - 45
6.5	3455	2980	2950	1735	1665	1518	1185; 1250	44 - 48
6.6	3450	2950	2870	1720	1660	1520	1250; 1185	25 - 27
6.7	3450	2950	2870	1720	1660	1520	1250; 1185	34 - 36
6.8	3450	2950	2870	1720	1660	1520	1250; 1185	38 - 39
6.9	3450	2950	2870	1720	1660	1520	1250; 1185	46 - 48
6.10	3450	2950	2865	1720	1660	1520	1250; 1185	53 - 56
6.11	3450	2950	2870	1720	1665	1520	1250; 1185	60 - 62
6.12	3450	2950	2870	1720	1660	1520	1250; 1185	66 - 70
6.13	3450	2945	2870	1719	1660	1520	1250; 1185	oil
6.14	3450	2950	2870	1720	1660	1520	1240; 1185	29 - 33
6.15	3455	2950	2870	1720	1665	1518	1250; 1185	32 - 35
6.16	3450	2950	2870	1717	1660	1520	1250; 1185	33 - 37
6.17	3450	2950	2870	1720	1664	1525	1252; 1185	36 - 40
6.18	3454	2950	2870	1720	1665	1520	1250; 1185	46 - 49
6.19	3454	2950	2870	1720	1660	1520	1250; 1185	47 - 50
6.20	3450	2950	2870	1720	1665	1520	1250; 1190	28 - 31
6.21	3450	2945	2870	1720	1660	1520	1250; 1185	37 - 39
6.22	3450	2950	2870	1723	1660	1518	1250; 1185	51 - 54
6.23	3450	2950	2870	1720	1655	1520	1250; 1185	47 - 49

Table XVI: Melting point [°C] and IR spectra of the secondary alkyl ω-acetylaminoalkanoates (measured in $CHCl_3$) [cm $^{-1}$]

Product No.	νNH	$\nu_a CH_2$	νCO ester	νCO amide	δNH amide	νCOC	M.P. [°C]
7.1	3450	2950	1735	1665	1520	1185; 1250	oil
7.2	3455	2950	1735	1665	1520	1187; 1250	oil
7.3	3450	2955	1734	1665	1520	1185; 1250	oil
7.4	3450	2950	1735	1668	1525	1180; 1250	oil
7.5	3455	2950	1735	1665	1518	1185; 1250	oil
7.6	3450	2870	1720	1660	1520	1250; 1185	oil
7.7	3450	2870	1720	1660	1520	1250; 1185	oil
7.8	3450	2870	1720	1660	1520	1250; 1185	oil
7.9	3450	2870	1720	1660	1520	1250; 1185	oil
7.10	3450	2865	1720	1660	1520	1250; 1185	oil
7.11	3454	2870	1725	1665	1520	1250; 1185	oil
7.12	3450	2870	1720	1660	1520	1250; 1185	oil
7.13	3450	2870	1719	1660	1520	1250; 1185	oil
7.14	3450	2870	1720	1660	1520	1240; 1185	oil
7.15	3455	2870	1720	1665	1518	1255; 1178	oil
7.16	3450	2870	1724	1660	1520	1250; 1185	oil
7.17	3450	2870	1720	1664	1525	1252; 1185	oil
7.18	3454	2870	1720	1665	1520	1250; 1185	oil
7.19	3454	2870	1720	1660	1520	1250; 1185	oil
7.20	3450	2870	1720	1665	1520	1250; 1190	oil
7.21	3450	2868	1720	1665	1520	1250; 1185	oil
7.22	3450	2870	1723	1660	1518	1250; 1185	oil
7.23	3450	2870	1720	1665	1520	1250; 1190	oil
7.24	3450	2870	1720	1665	1520	1250; 1190	oil
7.25	3450	2870	1720	1665	1520	1250; 1190	oil
7.26	3450	2875	1720	1660	1520	1250; 1190	oil
7.27	3450	2870	1720	1665	1515	1250; 1190	oil
7.28	3450	2865	1720	1665	1520	1250; 1190	oil
7.29	3450	2870	1720	1665	1520	1250; 1185	oil
7.30	3450	2870	1720	1674	1520	1250; 1190	oil
7.31	3450	2870	1720	1655	1518	1245; 1190	oil
7.32	3460	2870	1720	1660	1520	1254; 1190	oil
7.33	3450	2870	1720	1665	1520	1250; 1190	oil
7.34	3450	2870	1728	1665	1520	1250; 1190	oil
7.35	3450	2870	1720	1660	1520	1250; 1194	oil
7.36	3450	2865	1720	1667	1520	1250; 1190	oil

Table XVII: 1H NMR spectra of secondary alkyl ω-aminoalkanoates

No.	3H CH_3	3H CH_3	n . H CH_2 *	2H CH_2CO	2H CH_2NH_2	1H CHO	2H NH_2
2.1	0,89t, J=6	1,20d, J=6	1,23qs, 8H(4); 1,50m, 6H(3)	2,29t, J=7	2,73bs	4,91m	2,39bs
2.2	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 16H(3+3+1+NH_2)	2,30t, J=6,5	2,79bs	4,82m	-
2.3	0,90t, J=6,5	0,90t, J=6,5	1,25-1,80m, 16H(2+2+3+NH_2)	2,30t, J=6,5	2,79bs	4,91m	-
2.4	0,88t, J=6	1,19d, J=6	1,27qs, 10H(5); 1,46m, 6H(3)	2,30t, J=7	2,77bs	4,90m	3,33bs
2.5	0,88t, J=7	0,88t, J=7	1,25-1,80m, 18H(4+3+1+NH_2)	2,31t, J=6	2,72bs	4,82m	-
2.6	0,88t, J=6	1,20d, J=6	1,28qs, 12H(6); 1,46m, 6H(3)	2,30t, J=7	2,73bs	4,92m	1,96bs
2.7	0,89t, J=7	0,89t, J=7	1,20-1,80m, 20H(5+3+1+NH_2)	2,32t, J=6,5	2,74bs	4,84m	-
2.8	0,89t, J=6,5	0,89t, J=6,5	1,25-1,80m, 20H(4+3+2+NH_2)	2,31t, J=6	2,95bs	4,87m	-
2.9	0,89t, J=6,5	0,89t, J=6,5	1,25-1,80m, 20H(3+3+3+NH_2)	2,31t, J=6,5	2,73bs	4,90m	-
2.10	0,89t, J=6	1,21d, J=6	1,29qs, 14H(7); 1,46m, 6H(3)	2,30t, J=7	2,72bs	4,92m	1,77bs
2.11	0,89t, J=6	1,19d, J=6	1,28qs, 16H(8); 1,46m, 6H(3)	2,30t, J=7	2,74bs	4,91m	Překryt $(CH_2)_3$
2.12	0,88t, J=6,5	1,20d, J=6,5	1,28qs, 18H(9); 1,46m, 6H(3)	2,31t, J=6,5	2,73bs	4,91m	1,77bs
2.13	0,89t, J=6	0,89t, J=6	1,25-1,80m, 30H(6+5+3+NH_2)	2,30t, J=6,5	2,72bs	4,91m	-
2.14	0,88t, J=6	1,20d, J=6	1,27qs, 8H(4); 1,46m, 8H(4)	2,31t, J=6,5	2,72bs	4,90m	1,80bs
2.15	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 18H(4+3+1+NH_2)	2,31t, J=6,5	2,74bs	4,91m	-
2.16	0,89t, J=6	0,89t, J=6	1,20-1,80m, 18H(4+2+2+NH_2)	2,30t, J=7	2,73bs	4,92m	-
2.17	0,88t, J=6,5	1,21d, J=6,5	1,28qs, 10H(5); 1,46m, 8H(4)	2,31t, J=6,5	2,72bs	4,91m	1,85bs
2.18	0,89t, J=6	0,89t, J=6	1,20-1,80m, 20H(4+4+1+NH_2)	2,31t, J=6,5	2,73bs	4,90m	-
2.19	0,89t, J=6,5	1,20d, J=6,5	1,29qs, 12H(6); 1,46m, 8H(4)	2,32t, J=6,5	2,74bs	4,92m	1,80bs
2.20	0,88t, J=7	0,88t, J=7	1,20-1,80m, 22H(5+4+1+NH_2)	2,30t, J=6	2,73bs	4,92m	-
2.21	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 22H(4+4+2+NH_2)	2,31t, J=6,5	2,73bs	4,91m	-

Table XVII: 1H NMR spectra of secondary alkyl ω-aminoalkanoates (continued)

No.	3H CH_3	3H CH_3	n . H CH_2 *	2H CH_2CO	2H CH_2NH_2	1H CHO	2H NH_2
2.22	0,89t, J=6	0,89t, J=6	1,20-1,80m, 22H(4+3+3+NH_2)	2,32t, J=6,5	2,73bs	4,90m	-
2.23	0,89t, J=6,5	1,21d, J=6,5	1,29qs, 14H(7); 1,46m, 8H(4)	2,31t, J=6,5	2,72bs	4,92m	1,77bs
2.24	0,89t, J=6	1,20d, J=6	1,28qs, 16H(8); 1,46m, 8H(4)	2,30t, J=6,5	2,73bs	4,91m	1,80bs
2.25	0,88t, J=6	1,21d, J=6	1,29qs, 18(9); 1,46m, 8H(4)	2,31t, J=6,5	2,74bs	4,92m	1,80bs
2.26	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 32H(6+5+4+NH_2)	2,32t, J=6,5	2,73bs	4,90m	-
2.27	0,89t, J=6	1,20d, J=6	1,28qs, 10H(4); 1,46m, 8H(4)	2,32t, J=6,5	2,72bs	4,90m	1,80bs
2.28	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 20H(4+3+1+NH_2)	2,32t, J=6,5	2,73bs	4,92m	-
2.29	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 20H(4+2+2+NH_2)	2,32t, J=7	2,74bs	4,92m	-
2.30	0,88t, J=6	1,20d, J=6	1,28qs, 10H(5); 1,46m, 10H(5)	2,32t, J=6,5	2,73bs	4,91m	1,85bs
2.31	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 22H(5+4+1+NH_2)	2,31t, J=6,5	2,72bs	4,91m	-
2.32	0,88t, J=6,5	1,21d, J=6,5	1,29qs, 12H(6); 1,46m, 10H(5)	2,30t, J=6,5	2,73bs	4,92m	1,85bs
2.33	0,88t, J=6	0,88t, J=6	1,20-1,80m, 24H(5+5+1+NH_2)	2,32t, J=6,5	2,73bs	4,90m	-
2.34	0,88t, J=7	0,88t, J=7	1,20-1,80m, 24H(5+4+2+NH_2)	2,31t, J=6	2,73bs	4,92m	-
2.35	0,90t, J=6,5	0,90t, J=6,5	1,20-1,80m, 24H(5+3+3+NH_2)	2,30t, J=6,5	2,73bs	4,87m	-
2.36	0,89t, J=6,5	1,20d, J=6,5	1,28qs, 14H(7); 1,46m, 10H(5)	2,32t, J=6,5	2,74bs	4,92m	1,80bs
2.37	0,89t, J=6,5	1,21d, J=6,5	1,29qs, 16H(8); 1,46m, 10H(5)	2,32t, J=6,5	2,72bs	4,90m	1,77bs
2.38	0,88t, J=6	1,20d, J=6	1,28qs, 18(9); 1,46m, 10H(5)	2,30t, J=6,5	2,72bs	4,92m	1,80bs
2.39	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 34H(6+5+5+NH_2)	2,31t, J=6,5	2,73bs	4,91m	-

* n is number of H; figure in bracket is number of CH_2 groups

Table XVIII: 1H NMR spectra of primary alkyl 6-methyl- and 6-dimethylaminohexanoates

No.	3H CH_3	n . H CH_3	n . H CH_2	2H CH_2CO	2H CH_2O
3.1	0,89t, J=6	2,38s, 3H	1,20-1,80m, 20H(4+6)	2,32t, J=6,5	4,07t, J=7
3.2	0,88t, J=6	2,37s, 3H	1,20-1,80m, 22H(4+7)	2,31t, J=6,5	4,07t, J=7
3.3	0,88t, J=6	2,38s, 3H	1,20-1,80m, 24H(4+8)	2,32t, J=6,5	4,06t, J=7
3.4	0,89t, J=6	2,25s, 6H	1,20-1,80m, 20H(4+6)	2,32t, J=6,5	4,07t, J=7
3.5	0,88t, J=6	2,26s, 6H	1,20-1,80m, 22H(4+7)	2,32t, J=6,5	4,06t, J=7
3.6	0,88t, J=6	2,26s, 6H	1,20-1,80m, 24H(4+8)	2,31t, J=6,5	4,06t, J=7
3.7	0,89t, J=6	2,26s, 6H	1,20-1,80m, 26H(4+9)	2,32t, J=6,5	4,07t, J=7
3.8	0,89t, J=6	2,26s, 6H	1,20-1,80m, 28H(4+10)	2,31t, J=6,5	4,07t, J=7

* n is number of H; figure in bracket is number of CH_2 groups

Table XIX: 1H NMR spectra of cycloalkyl ω-aminoalkanoates

No.	n . H CH_2 *	2H CH_2CO	2H CH_2NH_2	1H CHO
5.1	1,55-1,80m, 16H(4+3+NH_2)	2,29t, J=7	2,80bs	4,94m
5.2	1,55-1,80m, 18H(5+3+NH_2)	2,29t, J=7	2,82bs	4,93m
5.3	1,53-1,80m, 20H(6+3+NH_2)	2,29t, J=7	2,80bs	4,95m
5.4	1,53-1,80m, 22H(7+3+NH_2)	2,29t, J=7	2,70bs	5,00m
5.5	1,55-1,80m, 20H(5+4+NH_2)	2,29t, J=7	2,80bs	4,95m
5.6	1,55-1,80m, 22H(6+4+NH_2)	2,29t, J=7	2,80bs	4,94m
5.7	1,53-1,80m, 24H(7+4+NH_2)	2,29t, J=7	2,82bs	4,95m
5.8	1,55-1,80m, 24H(7+5+NH_2)	2,29t, J=7	2,80bs	4,95m
5.9	1,55-1,80m, 26H(8+5+NH_2)	2,29t, J=7	2,82bs	4,93m

* n is number of H; figure in bracket is number of CH_2 groups

Table XX: 1H NMR spectra of alkyl ω-acetylaminoalkanoates

No.	3H CH_3	n . H CH_2 *	3H CH_3CO	2H CH_2CO	2H CH_2NH	2H CH_2O	1H NH
6.1	0,89t, J=6	1,28qs, 12H(6); 1,51m, 4H(2)	1,94s	2,30t, J=6,5	3,24m	4,07t, J=7	5,62bs
6.2	0,88t, J=6	1,29qs, 14H(7); 1,50m, 4H(2)	1,95s	2,30t, J=6,5	3,24m	4,06t, J=7	5,66bs
6.3	0,89t, J=6	1,29qs, 16H(8); 1,51m, 4H(2)	1,95s	2,31t, J=6,5	3,26m	4,07t, J=7	5,66bs
6.4	0,89t, J=6	1,28qs, 18H(9); 1,51m, 4H(2)	1,94s	2,30t, J=6,5	3,25m	4,07t, J=7	5,62bs
6.5	0,88t, J=6	1,29qs, 20H(10); 1,50m, 4H(2)	1,96s	2,30t, J=6,5	3,24m	4,06t, J=7	5,69bs
6.6	0,89t, J=6	1,28qs, 8H(4); 1,51m, 6H(3)	1,95s	2,31t, J=6,5	3,25m	4,07t, J=7	5,66bs
6.7	0,88t, J=6	1,29qs, 10H(5); 1,51m, 6H(3)	1,94s	2,30t, J=6,5	3,26m	4,06t, J=7	5,69bs
6.8	0,88t, J=6	1,28qs, 12H(6); 1,51m, 6H(3)	1,95s	2,31t, J=6,5	3,25m	4,07t, J=7	5,69bs
6.9	0,89t, J=6	1,29qs, 14H(7); 1,50m, 6H(3)	1,94s	2,31t, J=6,5	3,25m	4,06t, J=7	5,72bs
6.10	0,88t, J=6	1,29qs, 16H(8); 1,50m, 6H(3)	1,95s	2,31t, J=6,5	3,25m	4,06t, J=7	5,66bs
6.11	0,88t, J=6	1,28qs, 18H(9); 1,50m, 6H(3)	1,95s	2,31t, J=6,5	3,25m	4,06t, J=7	5,69bs
6.12	0,89t, J=6	1,28qs, 20H(10); 1,50m, 6H(3)	1,96s	2,31t, J=6,5	3,24m	4,07t, J=7	5,61bs
6.13	0,88t, J=6	1,28qs, 6H(3); 1,51m, 8H(4)	1,94s	2,31t, J=6,5	3,25m	4,07t, J=7	5,66bs
6.14	0,89t, J=6	1,28qs, 10H(5); 1,51m, 8H(4)	1,94s	2,30t, J=6,5	3,26m	4,06t, J=7	5,69bs
6.15	0,88t, J=6	1,29qs, 12H(6); 1,50m, 8H(4)	1,95s	2,31t, J=6,5	3,25m	4,06t, J=7	5,61bs
6.16	0,88t, J=6	1,28qs, 14H(7); 1,51m, 8H(4)	1,96s	2,31t, J=6,5	3,24m	4,06t, J=7	5,69bs
6.17	0,88t, J=6	1,29qs, 16H(8); 1,50m, 8H(4)	1,96s	2,30t, J=6,5	3,24m	4,07t, J=7	5,69bs
6.18	0,89t, J=6	1,29qs, 18H(9); 1,50m, 8H(4)	1,94s	2,31t, J=6,5	3,26m	4,07t, J=7	5,66bs
6.19	0,88t, J=6	1,28qs, 20H(10); 1,50m, 8H(4)	1,94s	2,31t, J=6,5	3,25m	4,07t, J=7	5,69bs
6.20	0,89t, J=6	1,29qs, 6H(3); 1,50m, 10H(5)	1,94s	2,30t, J=6,5	3,25m	4,07t, J=7	5,72bs
6.21	0,89t, J=6	1,29qs, 12H(6); 1,51m, 10H(5)	1,96s	2,30t, J=6,5	3,26m	4,06t, J=7	5,69bs

Table XX: 1H NMR spectra of alkyl ω-acetylaminoalkanoates (continued)

No.	3H CH_3	n . H CH_2 *	3H CH_3CO	2H CH_2CO	2H CH_2NH	2H CH_2O	1H NH
6.22	0,88t, J=6	1,28qs, 16H(8); 1,51m, 10H(5)	1,95s	2,31t, J=6,5	3,26m	4,07t, J=7	5,66bs
6.23	0,89t, J=6	1,28qs, 20H(10); 1,50m, 10H(5)	1,95s	2,31t, J=6,5	3,24m	4,06t, J=7	5,69bs

* n is number of H; figure in bracket is number of CH_2 groups

Table XXI: 1H NMR spectra of secondary alkyl ω-acetylaminoalkanoates

No.	3H CH_3	3H CH_3	n . H CH_2 *	3H CH_3CO	2H CH_2CO	2H CH_2NH	1H CHO	1H NH
7.1	0,89t, J=6	1,20d, J=6	1,20-1,80m, 12H(2+4)	1,97s	2,32t, J=6,5	3,25m	4,91m	5,85bs
7.2	0,87t, J=6,5	0,95t, J=6,5	1,20-1,80m, 12H(3+2+1)	1,97s	2,33t, J=6,5	3,26m	4,82m	5,91bs
7.3	0,89t, J=6	1,21d, J=6	1,20-1,80m, 14H(2+5)	1,97s	2,31t, J=6,5	3,25m	4,91m	5,74bs
7.4	0,88t, J=6	1,21d, J=6	1,20-1,80m, 16H(2+6)	1,97s	2,31t, J=6,5	3,26m	4,91m	5,79bs
7.5	0,87t, J=6,5	0,94t, J=6,5	1,20-1,80m, 16H(5+2+1)	1,97s	2,33t, J=6,5	3,27m	4,82m	5,70bs
7.6	0,89t, J=6,5	1,20d, J=6,5	1,20-1,80m, 18H(2+7)	1,97s	2,32t, J=6,5	3,26m	4,82m	5,79bs
7.7	0,87t, J=6	1,21d, J=6	1,20-1,80m, 14H(3+4)	1,97s	2,31t, J=6,5	3,27m	4,91m	5,79bs
7.8	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 14H(3+2+2)	1,97s	2,33t, J=6,5	3,25m	4,82m	5,85bs
7.9	0,89t, J=6	1,21d, J=6	1,20-1,80m, 16H(3+5)	1,97s	2,31t, J=6,5	3,26m	4,91m	5,79bs
7.10	0,87t, J=6,5	0,94t, J=6,5	1,20-1,80m, 16H(3+4+1)	1,97s	2,32t, J=6,5	3,27m	4,82m	5,79bs
7.11	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 18H(3+4+2)	1,97s	2,33t, J=6,5	3,25m	4,82m	5,85bs
7.12	0,87t, J=6,5	0,94t, J=6,5	1,20-1,80m, 18H(3+3+3)	1,97s	2,33t, J=6,5	3,27m	4,91m	5,85bs
7.13	0,88t, J=6	1,20d, J=6	1,20-1,80m, 20H(3+7)	1,97s	2,31t, J=6,5	3,25m	4,82m	5,79bs
7.14	0,89t, J=6	1,21d, J=6	1,20-1,80m, 22H(3+8)	1,97s	2,32t, J=6,5	3,26m	4,82m	5,79bs
7.15	0,88t, J=6,5	0,88t, J=6,5	1,20-1,80m, 28H(3+11)	1,96s	2,31t, J=6,5	3,25m	4,91m	5,79bs
7.16	0,89t, J=6	1,20d, J=6	1,20-1,80m, 16H(4+4)	1,96s	2,28t, J=6,5	3,24m	4,91m	5,60bs
7.17	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 16H(4+3+1)	1,97s	2,30t, J=6,5	3,24m	4,82m	5,65bs

Table XXI: 1H NMR spectra of secondary alkyl ω-acetylaminoalkanoates (continued)

No.	3H CH_3	3H CH_3	n . H CH_2 *	3H CH_3CO	2H CH_2CO	2H CH_2NH	1H CHO	1H NH
7.18	0,90t, J=6,5	0,90t, J=6,5	1,10-1,80m, 16H(4+2+2)	1,96s	2,30t, J=6,5	3,23m	4,91m	5,95bs
7.19	0,89t, J=6	1,20d, J=6	1,20-1,80m, 18H(4+5)	1,97s	2,27t, J=6,5	3,24m	4,91m	5,79bs
7.20	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 18H(4+4+1)	1,97s	2,30t, J=6,5	3,23m	4,82m	5,65bs
7.21	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 20H(4+6)	1,97s	2,30t, J=6,5	3,23m	4,82m	5,65bs
7.22	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 20H(4+5+1)	1,97s	2,30t, J=6,5	3,23m	4,82m	5,65bs
7.23	0,87t, J=6,5	0,94t, J=6,5	1,20-1,80m, 20H(4+4+2)	1,97s	2,32t, J=6,5	3,24m	4,82m	5,65bs
7.24	0,88t, J=6,5	0,95t, J=6,5	1,20-1,80m, 20H(4+3+3)	1,97s	2,30t, J=6,5	3,23m	4,82m	5,65bs
7.25	0,88t, J=6	1,20d, J=6	1,20-1,80m, 22H(4+7)	1,96s	2,30t, J=6,5	3,24m	4,91m	5,67bs
7.26	0,88t, J=6	1,21d, J=6	1,20-1,80m, 24H(4+8)	1,97s	2,28t, J=6,5	3,22m	4,82m	5,68bs
7.27	0,89t, J=6	1,19d, J=6	1,20-1,80m, 18H(5+4)	1,96s	2,27t, J=6,5	3,23m	4,91m	5,64bs
7.28	0,89t, J=6,5	0,95t, J=6,5	1,20-1,80m, 18H(5+3+1)	1,97s	2,30t, J=6,5	3,23m	4,82m	5,67bs
7.29	0,90t, J=6,5	0,90t, J=6,5	1,20-1,80m, 18H(5+2+2)	1,97s	2,28t, J=6,5	3,23m	4,92m	5,68bs
7.30	0,88t, J=6	1,19d, J=6	1,20-1,80m, 20H(5+5)	1,96s	2,26t, J=6,5	3,23m	4,90m	5,72bs
7.31	0,88t, J=6,5	0,88t, J=6,5	1,20-1,80m, 20H(5+4+1)	1,97s	2,29t, J=6,5	3,22m	4,81m	5,73bs
7.32	0,88t, J=6	1,19t, J=6	1,20-1,80m, 22H(5+6)	1,97s	2,27t, J=6,5	3,26m	4,91m	5,67bs
7.33	0,88t, J=6,5	0,88t, J=6,5	1,20-1,80m, 22H(5+5+1)	1,96s	2,30t, J=6,5	3,23m	4,82m	5,76bs
7.34	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 22H(5+4+2)	1,97s	2,29t, J=6,5	3,24m	4,82m	5,76bs
7.35	0,89t, J=6,5	0,89t, J=6,5	1,20-1,80m, 22H(5+3+3)	1,97s	2,29t, J=6,5	3,23m	4,88m	5,75bs
7.36	0,88t, J=6	1,20d, J=6	1,20-1,80m, 24H(5+7)	1,97s	2,30t, J=6,5	3,24m	4,88m	5,76bs
7.37	0,89t, J=6	1,21d, J=6	1,20-1,80m, 26H(5+8)	1,96s	2,29t, J=6,5	3,24m	4,82m	5,76bs

* n is number of H; figure in bracket is number of CH_2 groups

Table XXII: Elemental analysis of carbamates based on the cycloalkyl ω-aminoalkanoates

Product	% C		%H		%N	
No.	calc.	found	calc.	found	calc.	found
1.1	63.26	63.19	10.62	10.69	5.90	5.82
1.2	64.51	64.59	10.83	10.75	5.57	5.62
1.3	65.62	65.47	11.01	11.18	5.28	5.45
1.4	66.63	66.59	11.18	11.42	5.01	4.98
1.5	67.54	67.58	11.33	11.35	4.77	4.80
1.6	68.36	68.34	11.47	11.60	4.56	4.73
1.7	69.11	69.14	11.60	11.48	4.36	4.40
1.8	70.44	70.41	11.82	11.78	4.01	3.98
1.9	71.57	71.69	12.01	11.78	3.71	3.96
1.10	63.26	63.29	10.62	10.60	5.90	5.95
1.11	64.51	64.50	10.83	10.85	5.57	5.55
1.12	65.62	65.43	11.01	11.05	5.28	5.26
1.13	66.63	66.61	11.18	11.17	5.01	5.04
1.14	67.54	67.71	11.33	11.35	4.77	4.76
1.15	68.36	68.39	11.47	11.45	4.56	4.58
1.16	69.11	69.29	11.60	11.89	4.36	4.48
1.17	69.81	69.64	11.72	11.49	4.17	4.30
1.18	71.03	71.00	11.92	11.89	3.85	3.83
1.19	72.07	72.26	12.10	12.07	3.58	3.81
1.20	64.51	64.39	10.83	10.84	5.57	5.80
1.21	65.62	65.65	11.01	11.03	5.28	5.25
1.22	66.63	66.82	11.18	11.21	5.01	5.23
1.23	67.54	67.55	11.33	11.30	4.77	4.79
1.24	68.36	68.59	11.47	11.45	4.56	4.34
1.25	69.11	69.24	11.60	11.39	4.36	4.38
1.26	69.81	69.78	11.72	11.73	4.17	4.15
1.27	70.44	70.42	11.82	11.85	4.01	3.88
1.28	71.57	71.60	12.01	11.99	3.71	3.70
1.29	72.54	72.53	12.17	12.34	3.45	3.47
1.30	69.11	69.13	11.60	11.57	4.36	4.39
1.31	69.81	69.70	11.72	11.49	4.17	4.19

Table XXIII: Elemental analysis of carbamates based on the cycloalkyl ω-aminoalkanoates

Product	% C		%H		%N	
No.	calc.	found	calc.	found	calc.	found
4.1	69.55	69.48	11.04	10.93	4.38	4.22
4.2	69.12	68.91	7.86	7.95	5.20	5.37
4.3	68.96	68.91	9.74	9.35	4.87	5.01
4.4	70.44	70.56	10.91	11.15	4.21	4.36
4.5	69.94	69.70	8.18	8.38	4.94	5.05
4.6	69.73	69.56	9.70	9.49	4.65	4.82
4.7	71.05	70.85	11.05	11.32	4.04	3.89
4.8	70.68	70.95	8.47	8.22	4.71	4.63
4.9	74.44	74.23	9.91	10.12	4.44	4.64

Table XXIV: Elemental analysis of primary alkyl ω-acetylaminoalkanoates

Product	% C		% H		% N	
No.	calc.	found	calc.	found	calc.	found
6.1	66.38	66.44	10.77	10.62	5.16	4.98
6.2	67.33	67.48	10.95	10.84	4.91	5.13
6.3	68.19	67.97	11.11	11.32	4.68	4.45
6.4	68.97	68.74	11.25	11.13	4.47	4.35
6.5	69.68	69.82	11.39	11.18	4.28	4.07
6.6	65.34	65.57	10.57	10.65	5.44	5.36
6.7	66.38	66.53	10.77	10.54	5.16	5.03
6.8	67.33	67.52	10.95	11.14	4.91	5.01
6.9	68.19	67.97	11.11	11.32	4.68	4.36
6.10	68.97	69.09	11.25	11.06	4.47	4.35
6.11	69.68	69.82	11.39	11.22	4.28	4.07
6.12	70.34	70.48	11.51	11.39	4.10	3.92
6.14	67.33	68.54	10.94	10.56	4.90	4.58
6.15	68.19	67.94	11.11	10.94	4.68	5.01
6.16	68.97	69.12	11.25	10.99	4.47	4.19
6.17	69.68	69.51	11.39	11.42	4.28	4.23
6.18	70.34	70.19	11.51	11.51	4.10	4.15
6.19	70.94	70.80	11.62	11.78	3.94	4.08
6.20	66.38	66.16	10.77	10.56	5.16	4.98
6.21	68.97	68.94	11.25	11.27	4.47	4.60
6.22	70.34	70.32	11.51	11.60	4.10	4.30
6.23	71.50	71.28	11.73	11.44	3.79	4.18

Table XXV: Elemental analysis of the ω-aminoalkyl alkanoates

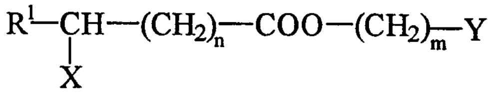
Product	% C		%H		%N	
No.	calc.	found	calc.	found	calc.	found
8.1	65.62	65.35	11.01	10.70	5.28	5.20
8.2	66.63	66.77	11.18	11.17	5.01	5.17
8.3	67.54	67.51	11.33	11.62	4.77	4.41
8.4	68.36	67.97	11.47	11.37	4.56	4.40
8.5	69.55	69.60	11.04	11.30	4.38	4.67
8.6	64.51	64.78	10.83	10.62	5.57	5.38
8.7	65.62	64.42	11.01	10.78	5.28	5.15
8.8	66.63	66.80	11.18	11.05	5.01	5.23
8.9	67.54	67.41	11.33	11.56	4.77	4.37
8.10	68.36	68.05	11.47	11.28	4.56	4.68

Table XXVI: The enhancement efficiency of selected ω-aminoalkanoates

Product No.	ER	Product No.	ER	Product No.	ER
1.1	4.5	2.1	3.5	3.1	12.2
1.7	39.3	2.5	1.8	3.3	39.3
1.9	13.8	2.6	17.3	3.4	15.8
1.12	5.3	2.9	5.2	3.6	28.3
1.14	23.1	2.13	2.3	3.8	17.4
1.16	3.8	2.14	4.8	4.1	1.4
1.21	3.9	2.20	5.2	4.3	1.1
1.24	5.2	2.26	1.9	4.4	1.1
1.26	3.8	2.29	2.2	4.6	0.5
1.29	1.8	3.36	1.8	4.7	1.1
1.33	5.8	2.39	1.2	4.8	1.0
5.1	1.9	6.15	1.6	7.15	1.9
5.4	2.1	6.18	4.8	7.19	1.9
5.6	1.8	6.19	2.2	7.25	1.2
6.1	2.9	6.23	1.1	7.33	1.0
6.3	4.6	7.1	2.1	8.1	39.8
6.5	8.3	7.6	3.2	8.3	41.2
6.8	3.5	7.7	1.8	8.5	44.8
6.9	13.2	7.12	2.2	8.6	29.2
6.12	5.4	7.14	1.1	8.10	22.1

CLAIMS:

1. ω-Amino acid derivatives of general formula (I)



$$R^1-\underset{\displaystyle X}{\underset{|}{C}H}-(CH_2)_n-COO-(CH_2)_m-Y$$

wherein R^1 is H or CH_3, X is H or NR^2R^3, wherein R^2 is H, CH_3, COH or $COCH_3$ and R^3 is H, CH_3 or COO^-Z, wherein Z is $R^2R^3\,NH^+CHR^1(CH_2)_nCOO(CH_2)_mCH_2Y$; Y is H, CH_3 or NHR^4, wherein R^4 is $COO^-NH_3^+CH_2(CH_2)_mOOC(CH_2)_nCH_3$, the meaning of group $(CH_2)_m$ being selected from alkyls, secondary alkyls, monocycloalkyls, bicycloalkyls and tricycloalkyls having from 4 to 15 carbon atoms and n having a value of from 3 to 14.

2. A method for the preparation of ω-amino acid derivatives of claim 1 characterised in that wherein an amino acid hydrochloride is reacted with thionyl chloride at a temperature of from 10 °C to 40 °C and the resulting aminoacylchloride hydrochloride is reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic and tricyclic alcohols in an aprotic medium at a temperature of from 20 °C to 90°C, giving rise to an amino acid ester hydrochloride which is then reacted with an amine in an aqueous or anhydrous medium, the basic ester being thereafter reacted with carbon dioxide.

3. A method for the preparation of ω-amino acid derivatives of claim 1 characterised in that an acylamino acid is reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic and tricyclic alcohols at temperatures of from 0 °C to 40 °C in an anhydrous aprotic medium under the presence of a condensing agent.

4. The method of claim 3 characterised in that the condensing agent used is dicyclohexylcarbodiimide or carbonyldiimidazole.

5. A method for the preparation of ω-amino acid derivatives of claim 1 characterised in that an acylamido acid is reacted with thionyl chloride at a temperature of from 20 °C to 40 °C, the resulting acylaminoacyl chloride being reacted with at least an equimolar amount of an alcohol selected from the group including primary, secondary, monocyclic, bicyclic, and tricyclic alcohols in an aprotic medium at a temperature of from 20 °C to 90 °C.

6. A method for the preparation of ω-amino acid derivatives of claim 1 characterised in that a carboxylic acid chloride is reacted with an α,ω-amino alcohol hydrochloride at a temperature of from 20 °C to 90 °C in an aprotic medium the amino ester hydrochloride being thereafter reacted with an amine in an aqueous or anhydrous medium and the basic amino ester being allowed to react with carbon dioxide.

7. Use of the compounds of claim 1 as transdermal penetration enhancers in topical pharmaceutical and cosmetic preparations.

8. Use of the compounds of claim 1 as enhancers of transdermal penetration from the hydrophobic vehicle of a topical preparation in the amount from 0.1 to 5 w/w per cent, preferably from 0.5 to 2.5 w/w per cent.

9. Use of the compounds of claim 1 as enhancers of transdermal penetration from a hydrophilic medium of a topical preparation in the amount from 0.1 to 5 w/w per cent, preferably from 0.5 to 1 w/w per cent.

10. Transdermal penetration enhancers destined for enhancing the penetration of physiologically active substances applied topically to human or animal skin in order to produce therapeutically effective concentrations of the active substances in deeper layers of the skin or produce therapeutically effective concentrations of the active substances in the circulatory system of living organisms, consisting of at least one compound of claim 1.