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(54) Titre : ANTIMOUSSÉS À BASE D'ÉMULSIONS D'HUILE DANS L'EAU POUR LA FABRICATION DU PAPIER
(54) Title: ANTIFOAMS FOR THE PAPER INDUSTRY BASED ON OIL-IN-WATER EMULSIONS

(57) **Abrégé/Abstract:**

Antifoams for the paper industry are based on oil-in-water emulsions in which the oil phase accounts for from 5 to 50% by weight of the emulsion and contains (a) an alcohol of not less than 12 carbon atoms, fatty esters of alcohols of not less than 22 carbon atoms and C₁-C₃₆-carboxylic acids, distillation residues which are obtainable in the preparation of alcohols having a relatively large number of carbon atoms by the oxo synthesis or by the Ziegler method and which may be alkoxyated, a mixture of the stated compounds and/or (b) a fatty ester of C₁₂-C₂₂-carboxylic acid with a monohydric to trihydric C₁-C₁₈-alcohol and, if required, (c) a hydrocarbon having a boiling point above 200°C or a fatty acid of 12 to 22 carbon atoms, in combination with (d) from 1 to 80% by weight of polyglyceryl esters which can be prepared by not less than 20% esterification of a polyglycerol mixture which contains, as essential components, di-, tri- and tetraglycerol and, if required, polyglycerols having higher degrees of condensation with saturated or unsaturated C₁₂-C₃₆-fatty acids.

Abstract of the Disclosure: Antifoams for the paper industry are based on oil-in-water emulsions in which the oil phase accounts for from 5 to 50% by weight of the emulsion and contains

- (a) an alcohol of not less than 12 carbon atoms, fatty esters of alcohols of not less than 22 carbon atoms and C₁-C₃₆-carboxylic acids, distillation residues which are obtainable in the preparation of alcohols having a relatively large number of carbon atoms by the oxo synthesis or by the Ziegler method and which may be alkoxyated, a mixture of the stated compounds and/or
- (b) a fatty ester of a C₁₂-C₂₂-carboxylic acid with a monohydric to trihydric C₁-C₁₈-alcohol and, if required,
- (c) a hydrocarbon having a boiling point above 200°C or a fatty acid of 12 to 22 carbon atoms,
in combination with
- (d) from 1 to 80% by weight of polyglyceryl esters which can be prepared by not less than 20% esterification of a polyglycerol mixture which contains, as essential components, di-, tri- and tetraglycerol and, if required, polyglycerols having higher degrees of condensation with saturated or unsaturated C₁₂-C₃₆-fatty acids.

Antifoams for the paper industry, based on oil-in-water emulsions

5 The present invention relates to antifoams for the paper industry, based on oil-in-water emulsions, in which the oil phase accounts for from 5 to 50% by weight of the emulsion, and contains a combination of known antifoams, for example long-chain alcohols or fatty esters of C₁₂-C₂₂-carboxylic acids and monohydric to trihydric alcohols, with polyglyceryl esters as essential components.

10 U.S. Patent 4,950,420 discloses antifoams for the paper industry which contain from 10 to 90% by weight of a surfactant polyether, such as polyoxyalkylated glycerol or polyalkoxylated sorbitol, and from 10 to 90% by weight of a fatty ester of a polyhydric alcohol, such as a mono- or diester of polyethylene glycol or polypropylene glycol. These antifoams are free of any oils, amides or water-repellent silica or silicone oils.

15 EP-A-0 140 812 discloses that antifoams based on oil-in-water emulsions, in which the oil phase of the emulsion contains

20 (a) a C₁₂-C₂₆-alcohol, distillation residues which have been obtained in the preparation of alcohols having a relatively high number of carbon atoms by the oxo synthesis or by the Ziegler method and may furthermore be alkoxyated and/or

25 (b) a fatty ester of a C₁₂-C₂₂-carboxylic acid with a monohydric to trihydric C₁-C₁₈-alcohol and, if required,

30 (c) a hydrocarbon having a boiling point above 200°C or a fatty acid of 12 to 22 carbon atoms,

35 accounts for from 15 to 60% by weight of the emulsion and has a mean particle size of from 0.5 to 15 μm, can be stabilized to an increase in viscosity and creaming during storage by adding from 0.05 to 0.5% by weight of a high molecular weight, water-soluble homo- or copolymer of acrylic acid, methacrylic acid, acrylamide or

methacrylamide.

5 JP-A-60/083559 and JP-A-61/227756 disclose the use of polyglyceryl fatty esters as antifoams in the production of foods, for example tofu. These formula-
10 tions contain no fatty alcohols; the presence of alkaline earth metal salts is, however, essential. Antifoam formulations are known to be effective only for the range of applications for which they have been developed, for example in the textile industry, food industry, paper industry, surface coating industry and leather industry. Owing to this specific effectiveness, antifoams cannot be successfully transferred to, or used in, other areas.

15 Antifoams based on oil-in-water emulsions, which are usually used in papermaking, are known to be less effective when the temperature of the aqueous system to be defoamed increases to above 35°C. At temperatures above 50°C, an even more rapid decrease in the effective-
20 ness of the antifoams occurs when the known oil-in-water emulsions are used. Since there is an increasing tendency to use closed water circulations in the paper mills, the result is an increase in the temperature of circulated water in papermaking, so that the effectiveness of the antifoams used to date is markedly reduced.

25 EP-A-0 322 830 discloses antifoams based on oil-in-water emulsions, in which the oil phase of the emulsions contains

30 (a) a C₁₂-C₂₆-alcohol, distillation residues which are obtainable in the preparation of alcohols having a relatively large number of carbon atoms by the oxo synthesis or by the Ziegler method and which may furthermore be alkoxyated and/or

35 (b) a fatty ester of a C₁₂-C₂₂-carboxylic acid with a monohydric to trihydric C₁-C₁₈-alcohol and, if required,

(c) a hydrocarbon having a boiling point above 200°C or a fatty acid of 12 to 22 carbon atoms,

accounts for from 5 to 50% by weight of the emulsion and has a mean particle size of $< 25 \mu\text{m}$, and in which from 5 to 50% by weight of components (a) and (b) of the oil phase of the oil-in-water emulsions have been replaced by

- 5 (d) one or more compounds which melt at above 70°C and are selected from the group consisting of the fatty alcohols of not less than 28 carbon atoms, the esters of a $\text{C}_1\text{-C}_{22}$ -carboxylic acid with an alcohol of not less than 28 carbon atoms, the adducts of
- 10 $\text{C}_2\text{-C}_4$ -alkylene oxides with alcohols of not less than 28 carbon atoms, the polyethylene waxes having a molecular weight of not less than 2,000, the carnauba waxes, the montanic ester waxes and the montanic acid waxes and salts thereof.

15 The oil-in-water emulsions are effective anti-foams in papermaking even at above 35°C , for example at from 50 to 60°C .

It is an object of the present invention to provide antifoams for the paper industry which, at 50°C or higher, are at least as effective as the products used

20 to date for this purpose or are even more effective than these.

We have found that this object is achieved, according to the invention, by antifoams for the paper industry, based on oil-in-water emulsions, in which the

25 oil phase accounts for from 5 to 50% by weight of the emulsion if the oil phase of the emulsions contains

- (a) an alcohol of not less than 12 carbon atoms, fatty esters of alcohols of not less than 22 carbon atoms
- 30 and $\text{C}_1\text{-C}_{36}$ -carboxylic acids, distillation residues which are obtainable in the preparation of alcohols having a relatively large number of carbon atoms by the oxo synthesis or by the Ziegler method and which may furthermore be alkoxyated, a mixture of the
- 35 stated compounds and/or
- (b) a fatty ester of a $\text{C}_{12}\text{-C}_{22}$ -carboxylic acid with a monohydric to trihydric $\text{C}_1\text{-C}_{18}$ -alcohol and, if

required,

(c) a hydrocarbon having a boiling point above 200°C or a fatty acid of 12 to 22 carbon atoms,

in combination with

- 5 (d) from 1 to 80% by weight of polyglyceryl esters which are obtainable by not less than 20% esterification of a polyglycerol mixture of
- 10 from 0 to 10% by weight of monoglycerol,
from 15 to 40% by weight of diglycerol,
from 30 to 55% by weight of triglycerol,
from 10 to 25% by weight of tetraglycerol,
from 0 to 15% by weight of pentaglycerol,
from 0 to 10% by weight of hexaglycerol and
- 15 from 0 to 5% by weight of polyglycerols having higher degrees of condensation with one or more fatty acids of 12 to 36 carbon atoms.

20 These antifoams are used, in amounts of from 0.02 to 0.5 part by weight per 100 parts by weight of the foam-forming medium, for preventing foam in pulp cooking, the beating of paper stock, papermaking and the dispersing of pigments for papermaking. In the stated amounts, they also act as deaerators in paper stocks.

25 In particular, alcohols of not less than 12 carbon atoms or mixtures of alcohols are used as component (a) of the oil-in-water emulsions. As a rule, these are monohydric alcohols which contain up to 48 carbon atoms in the molecule. Such products are commercially available. However, fatty alcohols which contain

30 a substantially larger number of carbon atoms in the molecule may also be used as component (a). Components (a) are either natural or synthetic alcohols. For example, lauryl alcohol, myristyl alcohol, cetyl alcohol, palmityl alcohol, stearyl alcohol, behenyl alcohol, oleyl alcohol, ricinoleyl alcohol, linoleyl alcohol and erucyl

35 alcohol are suitable.

Mixtures of alcohols, for example mixtures of (1)

alcohols of 12 to 26 carbon atoms and (2) alcohols of 28 to 48 carbon atoms, can also be used as component (a).

5 The synthetic alcohols, which are obtainable, for example, by the Ziegler method by oxidation of alkyl-aluminums, are saturated, straight-chain unbranched alcohols. Synthetic alcohols are also obtained by the oxo synthesis. As a rule, alcohol mixtures are obtained here. Distillation residues which are obtained in the preparation of the abovementioned alcohols by the oxo synthesis or by the Ziegler method can also be used as component (a) of the oil phase of the antifoam emulsions. Alkoxyated distillation residues which are obtained in the abovementioned processes for the preparation of higher alcohols by the oxo synthesis or by the Ziegler method are also suitable as component (a) of the oil phase of the antifoam emulsions. The oxyalkylated distillation residues are obtained by subjecting the distillation residues to alkoxylation with ethylene oxide or with propylene oxide or with a mixture of ethylene oxide and propylene oxide by a known method. Up to 5 ethylene oxide or propylene oxide groups undergo addition per OH group of the alcohol in the distillation residue. Preferably, 1 or 2 ethylene oxide groups undergo addition per OH group of the alcohol in the distillation residue.

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15
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25 Other suitable components (a) are fatty esters of alcohols of not less than 22 carbon atoms and C₁-C₃₆-carboxylic acids, for example montan waxes or carnauba waxes.

30 The abovementioned compounds of component (a), either alone or as a mixture with one another in any ratios as part of component (a), may form the oil phase of the oil-in-water emulsions.

35 The fatty esters of C₁₂-C₂₂-carboxylic acids with a monohydric to trihydric C₁-C₁₈-alcohol are used as component (b) of the oil phase of the antifoam emulsion. The fatty acids which form the basis of the esters are, for example, lauric acid, myristic acid, palmitic acid,

stearic acid, arachic acid and behenic acid. Palmitic acid or stearic acid is preferably used for the preparation of the esters. Monohydric C₁-C₁₈-alcohols can be used for esterifying the stated carboxylic acids, for example methanol, ethanol, propanol, butanol, hexanol, decanol and stearyl alcohol, as well as dihydric alcohols, such as ethylene glycol, or trihydric alcohols, such as glycerol. The polyhydric alcohols may be completely or partially esterified.

The oil phase of the emulsion may additionally be formed by a further class of water-insoluble compounds which are referred to below as component (c). The compounds of component (c) may account for up to 50% by weight, based on components (a) and (b), of the oil phase of the antifoam emulsions. They may be added either to a mixture of components (a) and (b) or to each of the compounds stated under (a) or (b). Suitable components (c) are hydrocarbons having a boiling point of more than 200°C at 1013 mbar and a pour point below 0°C, or fatty acids of 12 to 22 carbon atoms. Preferred hydrocarbons are liquid paraffins, such as the commercial paraffin mixtures, which are also referred to as white oil.

Components (a) and (b) can be used in any ratio for the preparation of the antifoam emulsions. Each of these two components may be present in the antifoams either alone or as a mixture with the other. In practice, for example, mixtures of (a) and (b) which contain from 40 to 60% by weight of component (a) and from 60 to 40% by weight of component (b) have proven useful. The oil phase of the oil-in-water emulsions may additionally contain one or more compounds (c). However, it is essential that at least one of the abovementioned components (a) and (b) in combination with one or more compounds of the following group (d) forms the oil phase of the oil-in-water emulsions. The compounds (d) account for from 1 to 80, preferably from 5 to 20, % by weight of the oil phase of the oil-in-water emulsions. This means

that the oil phase of the antifoam emulsions necessarily contains one of the following combinations: (a) and (d), (b) and (d) and (a), (b) and (d). The compounds of component (c) may be used in amounts of up to 40% by weight, based on the oil phase of the oil-in-water emulsions, in the case of all three abovementioned combinations of the composition of the oil phase.

Suitable components (d) of the oil phase are polyglyceryl esters which are obtainable by not less than 20% esterification of polyglycerol mixtures of from 0 to 10% by weight of glycerol, from 15 to 40% by weight of diglycerol, from 30 to 55% by weight of triglycerol, from 10 to 25% by weight of tetraglycerol, from 0 to 15% by weight of pentaglycerol, from 0 to 10% by weight of hexaglycerol and from 0 to 5% by weight of polyglycerols having a high degree of condensation with one or more fatty acids having 12 to 36 carbon atoms in the molecule. The polyglycerol mixtures described above are preferably esterified with fatty acids of 16 to 30 carbon atoms. The degree of esterification is from 20 to 100%, preferably from 60 to 100%. The fatty acids which are suitable for esterifying the polyglycerol mixtures may be saturated fatty acids as well as unsaturated fatty acids, for example lauric acid, myristic acid, palmitic acid, stearic acid, arachic acid, behenic acid and montanic acid. Ethylenically unsaturated fatty acids, for example oleic acid, hexadecenoic acids, elaidic acid, eicosenoic acids and docosenoic acids, such as erucic acid or brassidic acid, and polyunsaturated acids, such as octadecenedienoic acids and octatrienoic acids, such as linoleic acid and linolenic acid and mixtures of the stated saturated and unsaturated carboxylic acids are also suitable for esterifying the polyglycerol mixtures.

The polyglycerol mixtures are obtainable, for

example, by alkaline-catalyzed condensation of glycerol at elevated temperatures (cf. for example Fette, Seifen, Anstrichmittel, 88th year, No. 3, pages 101 to 106 (1986) or DE-A 3 842 692), by reacting glycerol with epichlorohydrin in the presence of an acidic catalyst at elevated temperatures. However, the mixtures are also obtainable by mixing the pure polyglycerol components, for example diglycerol, triglycerol and tetraglycerol, with one another. The polyglycerol mixtures which are not less than 20% esterified are prepared by esterifying the polyglycerol mixtures with the desired fatty acid or mixture of fatty acids by a known method. As a rule, the reaction is carried out in the presence of an acidic esterification catalyst, such as sulfuric acid, p-toluenesulfonic acid, citric acid, phosphorous acid, phosphoric acid or hypophosphorous acid, or of a basic catalyst, such as sodium methyrate or potassium tert-butylate.

The compounds of component (d) are present in an amount of from 1 to 80, preferably from 5 to 20, % by weight in the oil phase. The oil phase accounts for from 5 to 50% by weight of the oil-in-water emulsions, while the content of the aqueous phase in the emulsions is from 95 to 50% by weight, the percentages by weight summing to 100.

The oil phase is emulsified in the aqueous phase. Apparatuses in which the components of the emulsion are subjected to a strong shear gradient, for example dispersers, are required for this purpose. In order to obtain particularly stable oil-in-water emulsions, the emulsification of the oil phase in the aqueous phase is preferably carried out in the presence of surfactants which have an HLB value of more than 6 (for the definition of the HLB value, see W.C. Griffin, Journal of the Society of Cosmetic Chemists, 5 (1954), 249-246). The surfactants are oil-in-water emulsifiers or typical wetting agents. Among the surfactants, it is possible to

5 use anionic, cationic or nonionic compounds or mixtures
of these compounds which are compatible with one another,
for example mixtures of anionic and nonionic or of
cationic and nonionic wetting agents. Substances of the
10 stated type are, for example, sodium salts or ammonium
salts of higher fatty acids, such as ammonium oleate or
ammonium stearate, oxyalkylated phenols, such as nonyl-
phenol or isooctylphenol which have been reacted with
ethylene oxide in a molar ratio of from 1 : 2 to 1 : 50,
15 oxyethylated unsaturated oils, for example the reaction
products of one mol of castor oil and from 30 to 40 mol
of ethylene oxide or the reaction products of one mol of
sperm alcohol with from 60 to 80 mol of ethylene oxide.
Sulfated oxyethylation products of nonylphenol or octyl-
20 phenol are also preferably used as emulsifiers, said
products being present as the sodium or ammonium salt of
the corresponding sulfuric half-ester. 100 parts by
weight of the oil-in-water emulsions usually contain from
0.1 to 5 parts by weight of an emulsifier or of an
25 emulsifier mixture. In addition to the abovementioned
emulsifiers, protective colloids, such as high molecular
weight polysaccharides and soaps, or other conventional
additives, such as stabilizers, may also be used in the
preparation of the oil-in-water emulsions. For example,
30 the addition of from 0.05 to 0.5% by weight, based on the
total emulsion, of high molecular weight, water-soluble
homo- and copolymers of acrylic acid, methacrylic acid,
acrylamide or methacrylamide as a stabilizer has proven
useful. For example, EP-A 0 149 812 relates to the use
of such stabilizers.

Emulsifying the oil phase in the aqueous phase
gives oil-in-water emulsions which have a viscosity of
from 300 to 3,000 mPa.s immediately after preparation and
a mean particle size of the oil phase of less than 25 μm ,
35 preferably from 0.5 to 15 μm .

Although the compounds of component (d), alone or
as a mixture with component (c), have virtually no

activity as oil-in-water emulsion antifoams, combining a compound of component (d) with compounds (a) and/or (b) surprisingly results in a synergistic effect, which is most pronounced for the combination of (a) with (d) and (a) with (b) and (d). The addition of component (d) to the oil phase of antifoams which contain components (a) and/or (b) and, if required, further components in emulsified form has little or no adverse effect on the effectiveness of the resulting antifoams at relatively low temperatures, for example at room temperature, but increases the effectiveness of the antifoams to an unexpected extent in aqueous systems whose temperature is above 40°C. The novel oil-in-water emulsions are used in the paper industry in aqueous systems in which the formation of foam at relatively high temperatures must be prevented, for example in pulp cooking, in the beating of paper stock, in papermaking with closed water circulations in paper machines, and in the dispersing of pigments for papermaking. From 0.02 to 0.5, preferably from 0.05 to 0.3, part by weight of the oil-in-water antifoam emulsion is used per 100 parts by weight of paper stock in a foam-forming medium. When added to a paper stock suspension, the antifoams furthermore result in deaeration and are therefore also used as deaerators in papermaking (added to the paper stock). They are also suitable as antifoams in paper coating, where they are added to paper coating slips. The antifoams can also be used in the food industry, in the starch industry and in wastewater treatment plants for preventing foam. If they are added to the paper stock as a deaerator, the amounts used for this purpose are from 0.02 to 0.5 part by weight per 100 parts by weight of paper stock.

In the Examples which follow, parts and percentages are by weight. The mean particle size of the particles of the oil phase which are emulsified in water was determined using a Coulter counter. The K value of the polymers was determined according to H. Fikentscher,

EXAMPLE 1

An oil-in-water emulsion in which the oil phase accounts for 30% by weight of the emulsion and has a mean particle size of from 3 to 10 μm is prepared with the aid of a disperser.

The oil phase consists of the following components:

(a) 21 parts of a fatty alcohol mixture of C_{12} - C_{26} -alcohols,

(b) 5 parts of triesters of glycerol with C_{16} - C_{18} -fatty acids,

(c) 1 part of a mineral oil (commercial white oil) and

(d) 2 parts of a polyglyceryl ester which is obtainable by esterifying a polyglycerol mixture of

27% of diglycerol,

44% of triglycerol,

19% of tetraglycerol and

10% of polyglycerols having higher degrees of condensation

with a C_{12} - C_{26} -fatty acid mixture. The degree of esterification is 60%.

The water phase consists of:

65 parts of water,

3 parts of an emulsifier which is obtainable by subjecting 25 mol of ethylene oxide to an addition reaction with 1 mol of isooctylphenol and esterifying the adduct with sulfuric acid to give the half-ester,

1 part of a copolymer of 70% of acrylamide and 30% of acrylic acid, having a K value of 270, and

0.2 part of sodium hydroxide solution.

Components (a) to (d) are first heated to 110°C and then added to the aqueous phase at 80°C with dispersing. The oil-in-water emulsion thus obtained has a viscosity of 2650 mPa.s at 20°C immediately after preparation. The effectiveness of this antifoam emulsion is tested, as described above, on a paper stock suspension. The following results are obtained for the residual foam

index R in percent at each of the temperatures used for the paper stock suspension:

T (°C)	R (%)
30	22
50	11
60	26

COMPARATIVE EXAMPLE 1

An oil-in-water emulsion is prepared by the method stated in Example 1, except that component (d) is omitted and the amount of the fatty alcohol mixture of component (a) is increased to 23 parts. An emulsion whose viscosity immediately after preparation, at 20°C, is 540 mPa.s is obtained. When this emulsion is tested, the following residual foam indices in percent are obtained for the temperatures of the paper stock suspension which are stated in the Table:

T (°C)	R (%)
30	17
50	42
60	68

If these values are compared with the residual foam index according to Example 1, it is evident that the foam index of the comparative emulsion at 30°C is slightly better than that of the emulsion according to Example 1. However, if the temperature of the paper stock suspension is increased to 50 or 60°C in the test, the inferiority of the emulsion according to Comparative Example 1 is clearly evident. At 60°C, the emulsion according to Example 1 is more than twice as effective as the emulsion according to Comparative Example 1.

EXAMPLE 2

Several oil-in-water emulsions, all of which have

the following identical qualitative composition, are prepared with the quantitative composition of the oil phase shown in Table 1:

- 5 (a) Fatty alcohol mixture of C₁₂-C₂₆-alcohols,
 (b) triesters of glycerol with C₁₆-C₁₈-fatty acids,
 (d) polyglyceryl esters prepared by 55% esterification
 of a polyglycerol mixture of
 27% of diglycerol,
 44% of triglycerol,
 10 19% of tetraglycerol and
 10% of polyglycerols having higher degrees of
 condensation
 with C₁₂-C₂₆-fatty acids.

15 In contrast to the emulsion according to Example
 1, the aqueous phase is brought to pH 6.5. This change
 leads to a substantial decrease in the viscosity of the
 emulsions.

Exam- ple	Composition of the oil phase [parts]			Viscosity	Residual foam R % at	
	(a)	(b)	(d)		30°C	50°C
20 2.1	23.0	6.2	1	370	27	15
25 2.2	22.0	6.2	2	390	23	9
2.3	21.0	6.2	3	460	28	12
30 2.4	4.0	24.2	2	290	36	17

EXAMPLE 3

An emulsion is prepared by the method described
 in Example 2, the aqueous phase of Example 1 remaining
 unchanged and the oil phase of the antifoam having the
 following composition:

- 35 (a) 22.0 parts of a fatty alcohol mixture of C₁₂-C₂₆-
 alcohols,
 (b) 6.2 parts of a triester of glycerol with a C₁₆-C₁₈-
 fatty acid and
 40 (d) 2 parts of polyglyceryl esters prepared by esterify-
 ing a polyglycerol mixture of

27% of diglycerol,
44% of triglycerol,
19% of tetraglycerol and
10% of polyglycerols having higher degrees of
condensation

with a montanic acid in a ratio of 1 : 3. The
degree of esterification is 60%.

The viscosity of this emulsion immediately after
preparation is 2930 mPa.s. Testing of the emulsion as an
antifoam is carried out by the method described above and
gives the following values

T (°C)	R (%)
30	20
50	11
60	25

EXAMPLE 4

An emulsion is prepared by the method described
in Example 2, the aqueous phase of Example 1 remaining
unchanged and the oil phase of the antifoam having the
following composition:

- (a) 22.0 parts of a fatty alcohol mixture of C₁₂-C₂₆-
alcohols,
- (b) 6.2 parts of a triester of glycerol with a C₁₆-C₁₈-
fatty acid and
- (d) 2 parts of polyglyceryl esters which are obtainable
by esterifying a polyglycerol mixture of
27% of diglycerol,
44% of triglycerol,
19% of tetraglycerol and
10% of polyglycerols having higher degrees of
condensation
with a C₂₂-fatty acid in a weight ratio of 1 : 2, the
degree of esterification being 40%.

The viscosity of this emulsion immediately after preparation is 660 mPa.s. The emulsion is tested as an antifoam by the method described above. The following results are obtained:

5

T (°C)	R (%)
30	15
50	14
60	31

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An antifoam for the paper industry, based on an
oil-in-water emulsion, in which the oil phase accounts
for from 5 to 50% by weight of the emulsion and contains

5 (a) an alcohol of not less than 12 carbon atoms, fatty
esters of alcohols of not less than 22 carbon atoms
and C₁-C₃₆-carboxylic acids, distillation residues
which are obtainable in the preparation of alcohols
10 having a relatively large number of carbon atoms by
the oxo synthesis or by the Ziegler method and which
may be alkoxyated, a mixture of the stated
compounds or

(b) a fatty ester of a C₁₂-C₂₂-carboxylic acid with a
monohydric to trihydric C₁-C₁₈-alcohol and, if
15 required,

(c) a hydrocarbon having a boiling point above 200°C or
a fatty acid of 12 to 22 carbon atoms,

in combination with

(d) from 1 to 80% by weight of polyglyceryl esters which
20 are obtainable by not less than 20% esterification
of a polyglcerol mixture of
from 0 to 10% by weight of monoglycerol,
from 15 to 40% by weight of diglycerol,
from 30 to 55% by weight of triglycerol,
25 from 10 to 25% by weight of tetraglycerol,
from 0 to 15% by weight of pentaglycerol,
from 0 to 10% by weight of hexaglycerol and
from 0 to 5% by weight of polyglycerols having
higher degrees of condensation

30 with one or more fatty acids of 12 to 36 carbon atoms.

2. A process, for preventing foam in pulp cooking,
in the beating of paper stock, in papermaking and in the
dispersing of pigments for papermaking, which comprises
adding an effective amount of the antifoam claimed in
35 claim 1.

3. A process for preventing foam in paper stocks
which comprises adding the antifoam claimed in claim 1 in

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O.Z. 0050/42617

amounts of from 0.02 to 0.5 part by weight per 100 parts
by weight of paper stock.