

POLYMER MATERIAL

The present invention relates to a method of making a cellular polyurethane material by reacting an organic polyisocyanate with an essentially hydroxyl terminated polyol. The present invention also relates to cellular polyurethane material thus obtained which may be a soft, semi-rigid or rigid foam material.

- 10 Polyurethane foam materials are used in large amounts for a variety of applications. There are low or high density soft, flexible foams, semi-rigid and rigid foams. The soft, flexible foams and almost all the semi-rigid and rigid polyurethane foams are formed using blowing agents. These
- 15 blowing agents usually were chlorofluorocarbons (CFC's). The CFC's have excellent volatility, low flammability and very good thermal characteristics, but their main disadvantage is their high ozone depleting potential (ODP). This is the reason why the CFC's are being banned from the
- 20 refrigeration and cooling technology and as a polyurethane blowing agent. As an alternative alkanes, water and HCFC's have been proposed as blowing agents. The major problem is here, however, that the solubility and compatibility characteristics of these new blowing agents were such, that
- 25 new formulations of the polyurethane forming components had to be developed. Thus for example, the polyether polyols used in polyurethane material preparation show a poor compatibility with these alternative blowing agents, in particular with pentane.
- 30 The modification of the polyurethane components often leads to less desirable properties with regard to pore size of the cellular material formed, insulating properties and the flame retardant properties of the polyurethane material. Not seldom the improvement of one property is obtained at
- 35 the cost of another property.

It has now been found that the use of polyols in combination with a certain multifunctional additive considerably improves the compatibility of the polyurethane forming components with the alternative blowing agents, especially with pentane.

The term "multifunctional" additive has deliberately been used, since it has also been found that the use of this multifunctional additive in polyol based polyurethane foam systems leads to a very uniform, fine pore size cellular material. The fine pores obtained lead to better insulating properties of the polyurethane foam material which at the same time has a low volume weight.

Furthermore it has been found that the use of the multifunctional additive enabled the use of polyols with high functionality, but at the same time led to low viscosities of the mixtures of the polyurethane forming components.

Finally, it has also surprisingly been found that the flame retardant properties of the resulting polyurethane material are appreciably improved by the use of this multifunctional additive.

Thus the use of the additive led to an improvement of various properties at the same time and hence the term "multifunctional" additive appeared to be appropriate.

The multifunctional additive is an alkanolamine salt of polymerized fatty acids, and it is important to observe that this multifunctional additive is a salt and not the esterification or amidation product of the polymerized fatty acids. In order to obtain the salt of the alkanolamine and the polymerized fatty acids, the temperature in the salt forming reaction is kept as low as possible, preferably below 90°C.

Therefore the present invention relates to a method of making a polyurethane material by reacting an organic

polyisocyanate with an essentially hydroxyl terminated polyol in the presence of an effective amount of an alkanolamine salt of polymerized fatty acids in the presence of an inert, stable, vaporizable blowing agent.

- 5 The effective amount of the multifunctional additive, the alkanolamine salt of polymerized fatty acids, is in general between 10% and 100% by weight, and specifically from 25% to 45% by weight, based on the total weight of the polyol component.

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The invention also relates to cellular polyurethane material, selected from the group consisting of semi-rigid and rigid foam, which comprises the reaction product of:

- (a) an organic polyisocyanate;
15 (b) an essentially hydroxyl terminated polyol;
(c) an effective amount of an alkanolamine salt of polymerized fatty acids, and
(d) an, inert, stable, vaporizable blowing agent.

- 20 As the organic polyisocyanate aromatic, aliphatic, cycloaliphatic, araliphatic or heterocyclic isocyanates having least one, but preferably at least two, reactive isocyanate groups may be used. Suitable organic polyisocyanates are m-phenylene diisocyanate, 1,6-hexamethylene diisocyanate (HDI), toluene 2,4-diisocyanate, 25 toluene 2,6-diisocyanate (and commercial mixtures of these toluene diisocyanates (TDI); isophorone diisocyanate (IPDI), polyphenylene polymethylene polyisocyanates obtained by aniline-formaldehyde condensation and subsequent reaction with phosgene (so called crude MDI's); 30 cyclohexane 1,4-diisocyanate; 4,4'-diphenylmethane diisocyanate (MDI); toluene 2,4,6-triisocyanate; 3,3'-dimethyl-4,4'-diphenyl diisocyanate; 3,3'-diphenyl-4,4'-diphenylene diisocyanate; 4,4'4"-triphenylmethane triisocyanate; 1,5-naphthalene diisocyanate (NDI). Also 35 mixtures of organic polyisocyanates may be used, as well as

mixtures of monoisocyanates and polyisocyanates. Especially useful due to their availability are toluene diisocyanate, 4,4'-diphenylmethane diisocyanate and polymethylene, polyphenylene polyisocyanate.

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The essentially hydroxyl terminated polyol which is used comprises at least two reactive hydroxyl groups and may be a polyester and/or a polyether polyol. By the expression "essentially hydroxyl terminated" is understood that the polyol has almost no other reactive groups than hydroxyl groups capable of reacting with isocyanate groups. This implies that with polyester polyols the acid number of the polyester polyol is less than 5 and preferably less than 2.

15 Suitable polyester polyols have a functionality of 2 to 4, preferably 3 to 4, and can be prepared by methods known per se from aliphatic, cycloaliphatic, aromatic and/or heterocyclic, at least dicarboxylic acids or their derivatives, such as dicarboxylic acid anhydrides, dicarboxylic acid esters of lower monohydric alcohols having from 1 to 4 carbon atoms and dicarboxylic acid dichlorides. The acids may be straight or branched chain, saturated or unsaturated and can be substituted with e.g. halogen atoms. Suitable aliphatic dicarboxylic acids are those having from 2 to 12 carbon atoms, such as succinic acid, glutaric acid, adipic acid, azelaic acid, dodecanedioic acid; aromatic acids such as phthalic acid, terephthalic acid and isophthalic acid; cycloaliphatic acids such as 1,4-cyclohexane dicarboxylic acid; tetrahydrophthalic acid anhydride, tetrachlorophthalic acid anhydride; maleic acid and maleic acid anhydride, fumaric acid, and mixtures of these acids. Also monocarboxylic acids, such as fatty acids having from 8 to 22 carbon atoms, may be used in admixture with the polycarboxylic acids.

As polyhydric alcohols there may be used the glycols, such as ethylene glycol, propylene glycols, butylene glycols, 1,6-hexanediol, neopentyl glycol, polyalkylene glycols, 1,4-bis(hydroxymethyl)cyclohexane, and mixtures thereof.

- 5 Also alcohols containing three or more hydroxyl groups may be used together with the dihydric alcohols, such as glycerol, trimethylol ethane, trimethylol propane, pentaerythritol and mixtures thereof. Also alkanolamines, such as diethanolamine, triethanolamine and the like may be
10 used, so that polyesteramides are formed.

- The polyester polyol preferably contains residues of polymerized fatty acids or polymerized fatty alcohols. The polymerized fatty acids are obtained in a manner known per
15 se by polymerization of unsaturated fatty acids and the products are known as dimerized and/or trimerized fatty acids. The polymerized fatty acids comprise from 20 to 100% by weight of dimer acid, from 0 to 30% by weight of monomer acid and the remainder is trimer acid and higher polymers.
20 The polymerized fatty acids may at least partially be hydrogenated so as to remove any residual saturation. Suitably polymerized fatty acids are used containing at least 75% by weight of dimer acid, such as Pripol 1017 (Trade Mark, ex Unichema Chemie B.V., Gouda, the
25 Netherlands) having a dimer acid content of 75-82% by weight, a trimer acid content of 18-22% by weight and 1-3% by weight of monomer acid, an acid value of 192-197 and a saponification value of 195-202.

- The polyester polyol may also comprise a polymerized fatty
30 alcohol, which is obtained by hydrogenation of polymerized fatty acids or hydrogenolysis of polymerized fatty acid esters in the presence of copper chromite catalyst in a manner known per se. A suitable product is Pripol 2033 (Trade Mark, ex Unichema Chemie B.V., Gouda, the
35 Netherlands) having a hydroxyl value of 195-205 and comprising 97.5% by weight of dimer diol, and 0.5% by

weight each of monomer and trimer alcohol. The polymerized fatty alcohol may at least partially be hydrogenated so as to remove any residual unsaturation.

- 5 Also polyesters derived from lactones, such as caprolactone, may be used.

The essentially hydroxyl terminated polyether polyol is prepared by the addition reaction of an alkylene oxide
10 having from 2 to 5 carbon atoms, such as ethylene oxide and/or propylene oxide, with a polyhydric alcohol, which is called the starter or initiator.

Dependent on the type of starter material straight or branched chain polyether polyols are obtained.

- 15 Substantially straight chain or linear polyether polyols are those derived from alkylene oxides, glycols, heterocyclic ethers and other materials. The primary hydroxyl content may be increased by the separate reaction of the polyoxyalkylene polyol with ethylene oxide to form a
20 block copolymer with oxyethylene end groups.

Examples of branched chain polyether polyols are the reaction products of glycerol, trimethylol propane pentaerythritol, 1,2,6-hexanetriol, styrene-vinyl alcohol copolymer, sucrose, sorbitol and the like materials with
25 alkylene oxides. A typical triol is made by the addition polymerization of 50-55 moles of propylene oxide and 10-15 moles of ethylene oxide onto 1 mole of glycerol or trimethylolpropane.

- 30 In the present invention also mixtures of essentially hydroxyl terminated polyester polyols and polyether polyols may be used.

The multifunctional additive is an alkanolamine salt of
35 polymerized fatty acids.

The alkanolamine is selected from the alkanolamines in which the alkyl portion is usually lower alkyl, i.e. C1-C5 alkyl. Other substituents may be present in the amine group, provided that at least one hydroxyl group remains
5 and therefore other lower alkanolamines such as dimethyl methanolamine are also suitable.

Preferably the alkanolamine is triethanolamine or tri-isopropanolamine.

The polymerized fatty acid used for the formation of the
10 alkanolamine salt should have such a composition that the salt upon incorporation into the formulation leads to an acceptable viscosity of the mixture. Thus the polymerized fatty acid preferably has a monomer acid content of 0 to 80% by weight, a dimer acid content of 10 to 100% by weight
15 and a trimer acid content of 0 to 75% by weight. The polymerized fatty acid may at least partially be hydrogenated so as to remove residual unsaturation. The triethanolamine salt of polymerized fatty acid having 50% by weight dimer acid, 10% by weight trimer acid and 40% by
20 weight monomer acid is preferred.

Also different acid/amine equivalent ratios may be used, such as 0.1-1.0 equivalent acid to 1 equivalent of the amine. Preferably an equivalent ratio of 1.0 equivalent of acid per 1.0 equivalent of amine is used. It is essential
25 that no ester and/or amide linkages are formed and hence in the salt forming reaction the temperature is kept below 90°C, preferably below 80°C.

The amount of multifunctional additive applied may vary according to the technique of polyurethane material
30 formation and according to the specific application of the polyurethane material, but in general is from 10% to 100% by weight and preferably from 25% to 45% by weight, based on the total weight of the polyol component of the total composition.

In the method of making polyurethane material an inert, stable, vaporizable blowing agent is used. This blowing agent preferably is halogen-free and is selected from the group consisting of water, carbon dioxide, nitrogen, the noble gases (like argon) and the alkanes and cycloalkanes having a molecular weight of at most 100, and mixtures thereof. The use of pentane, isopentane and cyclopentane is preferred. Also trichloromonofluoromethane, dichlorodifluoromethane, and/or methylene chloride may be used.

Further effective amounts of various additives may be used, such as catalysts (suitable materials are alkali metal acetate, alkali metal octoate, tertiary amines such as N-methylmorpholine, 1,4-diazabicyclo(2.2.2) octane, dimethylcyclohexylamine (DMCHA), tin salts of carboxylic acids, dibutyltin dilaurate, and organometallic compounds such as organic titanates); pore stabilizing agents (such as polydimethyl siloxane); flame retardants (such as ammonium salts of phosphoric acid, metaphosphoric acid, polyphosphoric acid, C1-C5 alkyl esters of C1-C5 alkane phosphonates like methylphosphonic acid dimethyl ester (DMMP), ethylphosphonic diethylester, zinc borate, barium metaborate, halogen compounds like 2,3-dibromo-1,4-butanediol, or tris(2-chloro-ethyl)phosphate; tris (monochloro-isopropyl)phosphate); emulsifiers or surface-active agents (such as fatty acid alkanolamide ethoxylates, silicones, alkali metal salts of polymerized fatty acids; nonionics are preferred); pigments, dyes; fillers (such as silica gel, carbon black); stabilizers; fungicides, and mixtures thereof. The additives may be used in small amounts from 0.001% by weight of the total composition to larger amounts, up to 50% by weight of the total composition. The flame retardants are for example used in larger amounts.

It is known from German Patent Specification DE-A-960,855 (Farbenfabriken Bayer A.G.) to manufacture urethane based foam material in the presence of the diethanolamine salt of stearic acid, in general secondary aliphatic amine salts of C10-C20 fatty acids. This additive is used as a shrinkage control agent, however.

The invention will now be illustrated on hand of the following examples.

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EXAMPLE 1

The triethanolamine salt of polymerized fatty acids was prepared as follows:

15 325 grams of polymerized fatty acids (41.3% by weight of monomer acid, 50.6% by weight of dimer acid and 8.1% by weight of trimer acid) were heated under nitrogen to 60°-90°C while stirring and subsequently 165 grams of triethanolamine (comprising 85% by weight of

20 triethanolamine, remainder diethanolamine) were added, after which the mixture was kept at the same temperature under nitrogen for 1 hour while stirring. A clear liquid was obtained. The triethanolamine salt of the polymerized fatty acid was admixed with a hydroxyl terminated polyester

25 polyol in equal amounts by weight, the polyester polyol having a hydroxyl value of 400, an acid number of 1.5 and a functionality of 3.0. This polyester polyol was obtained by reacting 1.78 moles of phthalic acid anhydride, 1.31 moles of oleic acid, 1.01 moles of diethylene glycol and 3.12

30 moles of glycerol.

The essentially hydroxyl terminated polyester polyol with the functional additive was tested with regard to its behaviour with regard to pentane and cyclopentane

35 solubility. This evaluation was carried out with a mixture of the following composition:

	Polyester polyol	100	parts by weight
	Tegostab B-8450 ¹⁾	1.0	
	Dimethyl cyclohexylamine	0.9	
	Water	1.5	
5	Tris (monochloroisopropyl) phosphate	10	
	Dimethyl methylphosphonate	10	
	¹⁾ A polyethersiloxane ex Th. Goldschmidt A.G., Essen, Germany (Trade Mark).		

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The compatibility with pentane and cyclopentane was measured by addition of the blowing agent by titration to the polyurethane foam system. At the moment the mixture started to become turbid, the components were regarded not to be compatible any longer. Afterwards the amount of added pentane or cyclopentane was calculated by weighing.

The titrated samples were stored for another 48 hours at room temperature in firmly closed glass flasks to observe possible separation of the pentane or cyclopentane. If separation had occurred, the compatibility results were recalculated.

The following results were obtained:

25	Compatibility with:	Pentane:	Cyclopentane:
	Polyether polyol	4.3	6.3
	Polyester polyol	9.3	10.4
	Polyester polyol with multifunctional additive	27.4	61.5

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The compatibility has been expressed in % by weight of alkane based on the total mixture. The effect of the triethanolamine salt of polymerized fatty acids on the compatibility with the blowing agent is pronounced. The polyether polyol was an aliphatic polyether polyol with a hydroxyl value of 590 (Caradol LP 585-01, Trade Mark, ex Shell Chemicals, UK, a sucrose based polyether).

With the use of new blowing agents for polyurethane foams it has become more difficult to manufacture polyurethane foam with equal low lambda values as with CFC's. Pentane-blown foams very often end up at approximately 20% higher levels or more (initially) than CFC-blown materials. Apart from the amount of closed cells and the type of blowing agent, cell size and cell size distribution are important factors to obtain low initial lambda-values. The cell size may amongst others be influenced by the choice of the right surface-active agent, but also by the compatibility of the components of the polyurethane system with the blowing agent.

The experiments were carried out with the same system as used for the testing of the pentane compatibility, using pentane as the blowing agent. After 24 hours of curing the foam, the insulation values were measured according to German Industrial Standard DIN 52,612 Part 1 (guarded hot plate, middle temperature 23°C).

The hydroxyl terminated polyester polyol was mixed with the aliphatic polyether polyol having a hydroxyl value of 410 (Voranol RN-411; Trade Mark; a polyether polyol ex Dow Chemical Corp USA) in a weight ratio of 70% by weight of polyether polyol and 30% by weight of polyester polyol.

The formulations used were as follows:

<u>Formulation</u> (in parts by weight):		A	B
	Voranol RN-411	65	20
	Polyester polyol	--	22.5
5	Functionality polyol blend	3.7	3.7
	Water	2.0	2.0
	Tegostab B-8450	1.0	1.0
	Dimethyl cyclohexylamine	1.6	1.6
	Tris (monochloro-isopropyl) phosphate	7	7
10	Dimethyl methylphosphonate	10	10
	n-pentane	13	13
	Triethanolamine salt of polymerized fatty acids	-	22.5
15	Triethanolamine	2	2
	Glycerol	7	7
	Diphenylmethane-4,4'-diisocyanate	144	148
	(Suprasec DNR, Trade Mark, ex I.C.I. Plc. UK, NCO value 30.7; functionality 2.7)		

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The formulations (without the polyisocyanate) were mixed in a 1 litre polyethylene coated cardboard cup and, if necessary, the amount of blowing agent was adjusted after mixing. Then the calculated amount of polyisocyanate was

25 added to the mixture and the blend was mixed for 10 seconds at 3500 rpm using a Pendraulik high speed laboratory mixer with a mixing blade of 64 mm diameter. The mixture was then poured into a 10 litre polyethylene bag in which the foam was allowed to develop freely.

30 Before the material was tested for physical properties, the foam was post-cured for 24 hours at 70°C in a recirculating hot air oven and conditioned afterwards for 24 hours at 23°C and 50% relative humidity.

The insulation properties were determined according to

35 German Industrial Standard DIN 52,612 as follows: the insulation value was 20.8 mW/m.°K for the polyurethane foam material obtained with formulation B and 23.8 mW/m.°K for

the polyurethane foam material obtained with formulation A, thus clearly demonstrating that the polyurethane material obtained according to the present invention had the lowest initial lambda value. Upon inspection the foam material
 5 obtained with formulation B showed the finest cells. Both foams had comparable densities (approx. 30 kg/m³).

Finally the flame retardancy of the polyurethane foam material prepared for testing the insulation properties was
 10 investigated. In order to achieve a flame retardancy classification according to German Industrial Standard DIN 4102, Part 1, ("Kantbeflammung"), B-2 test, flame retardant additives need to be incorporated. In the experiments a mixture of tris (monochloro-isopropyl) phosphate and
 15 dimethyl methylphosphonate was used, because this mixture is known to be very effective in improving flame retardancy due to synergetic effects.

The following formulations were used (in parts by weight):

	A	B
20 Polyester polyol	-	22.5
Triethanolamine salt of polymerized fatty acids	-	22.5
25 Voranol RN-411 (Trade Mark; a polyether polyol with hydroxyl value 410, ex Dow Chemical Corp. USA)	65	20
Triethanolamine	2	2
Glycerol	7	7
Tris (monochloro-isopropyl) phosphate	7	7
30 Dimethyl methyl phosphonate	10	10
Tegostab B-8450	1.0	1.0
Dibutyltin dilaurate	0.05	0.05
Dimethyl cyclohexylamine	1.6	1.6
Water	2.0	2.0
35 n-pentane	13	13
Suprasec DNR	144	148

The amount of polyisocyanate was 10% in excess based on the hydroxyl value of the polyol and the amount of water used. The formulation A exhibited a flame height of 18 cm and formulation B showed a flame height of 13.5 cm. According
5 to the German Industrial Standard the limit is a maximal flame height of 15 cm. This implies that if this limit should be reached with formulation A, the amount of flame retardants should be increased by 50-100%, thus leading to an enormous increase in price.



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CLAIMS

REPLACED SHEETS SG

- ☐ Description : paged to paged
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1. A method of making a cellular polyurethane material by reacting an organic polyisocyanate with an essentially hydroxyl terminated polyol in the presence of an effective amount of an alkanolamine salt of polymerized fatty acids in the presence of an inert, stable, vaporizable blowing agent.
2. A method according to Claim 1, in which from 10% to 100% by weight, based on the total weight of the polyol components, of the alkanolamine salt of polymerized fatty acids is used.
3. A method according to Claim 1, in which from 25% to 45% by weight based on the total weight of the polyol components, of the alkanolamine salt of polymerized fatty acids is used.
4. A method according to Claim 1, in which the essentially hydroxyl terminated polyol comprises at least two reactive hydroxyl groups and is selected from the group consisting of polyester polyols, polyether polyols and mixtures thereof.
5. A method according to Claim 1, in which the hydroxyl terminated polyol is a polyester polyol comprising polymerized fatty acid residues.
6. A method according to Claim 1, in which the hydroxyl terminated polyol is a polyester polyol comprising polymerized fatty alcohol residues.
7. A method according to Claim 5, in which the polymerized fatty acid is at least partially hydrogenated.

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8. A method according to Claim 6, in which the polymerized fatty alcohol is at least partially hydrogenated.
9. A method according to Claim 1, in which the essentially hydroxyl terminated polyol is a polyester polyol having an acid number of at most 5.
10. A method according to Claim 1, in which the alkanolamine is selected from the group of alkanolamines having from 1 to 5 carbon atoms.
11. A method according to Claim 1, in which the alkanolamine is triethanolamine or triisopropanolamine.
12. A method according to Claim 1, in which the alkanolamine salt of polymerized fatty acids is derived from polymerized fatty acids having a monomer acid content of 0 - 80% by weight, a dimer acid content of 10 - 100% by weight and a trimer acid content of 0 - 75% by weight.
13. A method according to Claim 1, in which the triethanolamine salt of polymerized fatty acids, having a monomer acid content of 40% by weight, a dimer acid content of 50% by weight and a trimer acid content of 10% by weight is used.
14. A method according to Claim 1, in which the inert, stable, vaporizable blowing agent is selected from the group consisting of water, carbon dioxide, nitrogen, the noble gases, alkanes and cycloalkanes having a molecular weight of at most 100, and mixtures thereof.





15. A method according to Claim 1, in which the inert, stable, vaporizable blowing agent is an alkane or a cycloalkane having a molecular weight of at most 100.
16. A method according to Claim 1, in which inert, stable, vaporizable blowing agent is selected from the group consisting of pentane, isopentane, cyclopentane, and mixtures thereof.
17. A method according to Claim 1, in which from 0.001% to 50% by weight, based on the total composition, of an additive is used, selected from the group consisting of catalysts, pore stabilizing agents, flame retardants, emulsifiers, pigments, dyes, fillers, stabilizers, fungicides, and mixtures thereof.
18. A cellular polyurethane material comprising the reaction product of:
 - (a) an organic polyisocyanate;
 - (b) an essentially hydroxyl terminated polyol;
 - (c) from 10% to 100% by weight, based on the total weight of the polyol, of an alkanolamine salt of polymerized fatty acids, and
 - (d) an inert, stable, vaporizable blowing agent.
19. A cellular polyurethane material according to Claim 18, in which from 25% to 45% by weight, based on the polyol, of an alkanolamine salt of polymerized fatty acids is used.
20. A polyurethane material according to Claim 18, in which the hydroxyl terminated polyol is a polyester polyol comprising polymerized fatty acid residues.





21. A polyurethane material according to Claim 18, in which the hydroxyl terminated polyol is a polyester polyol comprising polymerized fatty alcohol residues.
22. A polyurethane material according to Claim 20, in which the polymerized fatty acid is at least partially hydrogenated.
23. A polyurethane material according to Claim 21, in which the polymerized fatty alcohol is at least partially hydrogenated.
24. A polyurethane material according to Claim 18, in which the alkanolamine is selected from the group of alkanolamines having from 1 to 5 carbon atoms.
25. A polyurethane material according to Claim 18, in which the alkanolamine is triethanolamine or triisopropanolamine.
26. A polyurethane material according to Claim 18, in which the alkanolamine salt is derived from polymerized fatty acids having a monomer acid content of 0 - 80% by weight, a dimer acid content of 10 - 100% by weight, and a trimer acid content of 0 - 75% by weight.
27. A polyurethane material according to Claim 18, in which the triethanolamine salt of polymerized fatty acids having a monomer acid content of 40% by weight, a dimer acid content of 50% by weight and a trimer acid content of 10% by weight is used.
28. A polyurethane material according to Claim 18, in which the inert, stable, vaporizable blowing agent





is selected from the group consisting of water, carbon dioxide, nitrogen, the noble gases, alkanes and cycloalkanes having a molecular weight of at most 100, and mixtures thereof.

29. A polyurethane material according to Claim 18, in which the inert, stable, vaporizable blowing agent is an alkane or cycloalkane having a molecular weight of at most 100.
30. A polyurethane material according to Claim 18, in which the inert, stable, vaporizable blowing agent is selected from the group consisting of pentane, isopentane, cyclopentane and mixtures thereof.
31. Use of an alkanolamine salt, in which the alkanolamine is selected from the group of alkanolamines having from 1 to 5 carbon atoms, of polymerized fatty acids having a monomer acid content of 0-80% by weight, a dimer acid content of 10-100% by weight, and a trimer acid content of 0-75% by weight as a multifunctional additive in the manufacture of cellular polyurethane material.
32. Use of the triethanolamine salt of polymerized fatty acids having a monomer acid content of 40% by weight, a dimer acid content of 50% by weight and a trimer acid content of 10% by weight as a multifunctional additive in the manufacture of cellular polyurethane material.

