oxide, sodium oxide, potassium oxide, calcium hydroxide, magnesium phosphate and mixtures thereof" (see the '203 publication at paragraph [0031]). Calcium oxide is used in the examples.

The preparation of N-acyl amino acid salts is particularly challenging when the reactants are fatty alkyl esters (particularly fatty methyl esters) and alkali metal glycinates, as in the preparation of sodium cocoyl glycinate, sodium myristyl glycinate, or sodium lauryl glycinate. This reaction is troublesome due to a lack of reagent compatibility, solidification of the reaction mixture at elevated process temperatures, color development, severe foaming during methanol removal, and significant by-product generation. Too often, conditions cannot be found that provide low-color N-acyl amino acid salts in high yield with minimal generation of fatty acid soaps and dipeptide by-products.

In sum, an improved process for making N-acyl amino acid salts is needed. In particular, the industry needs a process that avoids salt generation and the selectivity issues of other known routes. Preferably, the particular difficulties that complicate the preparation of N-acyl glycinates from fatty alkyl esters could be overcome. An ideal process would give high yields of low-color N-acyl amino acid salts with a reduced proportion of fatty acid soaps and dipeptide by-products.

SUMMARY ~~OF THE INVENTION~~

In one ~~aspect~~embodiment, the ~~invention~~ present disclosure relates to N-acyl amino acid salt compositions and an improved process for making them from fatty alkyl esters. The process comprises reacting a fatty alkyl ester with an amino acid salt in the presence of an alkoxide catalyst. The reaction is performed at a pressure of at least 5 psig. At least 10 mole percent of catalyst is used based on the amount of fatty alkyl ester used as a reactant. We surprisingly found that pressure and a minimum level of an alkoxide catalyst are needed to give high fatty alkyl ester conversions and good yields of the desired N-acyl amino acid salt. The resulting N-acyl amino acid salt compositions, which can be formulated at high actives levels, have low color, an acceptable level of fatty acid soaps, and a small proportion of di-acylated by-products.

In another ~~aspect~~embodiment, the ~~invention~~ present disclosure relates to an improved way to isolate an N-acyl amino acid salt. In this process, the N-acyl amino acid salt is isolated from unreacted starting materials (fatty alkyl ester, amino acid salt) in the N-acyl amino acid salt composition by forming a slurry of the composition in a C_1-C_4 alcohol, recovering the N-acyl amino acid salt from the slurry, and drying the N-acyl amino acid salt.

In another ~~aspect~~embodiment, the ~~invention~~ present disclosure relates to a single-phase mixture comprising a fatty alkyl ester and an amino acid salt. The single-phase mixture may comprise at least 10 mole %, based on the amount of fatty alkyl ester, of an alkoxide catalyst. In another ~~aspect~~embodiment, the single-phase mixture comprises an amino acid salt mixture; this salt mixture comprises a non-glycinate amino acid salt and at least 20 mole % of a glycinate salt. In another ~~aspect~~embodiment, the single-phase mixture comprises at least a 30 mole % excess of the fatty alkyl ester or at least a 30 mole% excess of the amino acid salt. We surprisingly found that achieving a single-phase mixture of starting materials by one of the above methods is valuable for achieving good conversions when reacting amino acid salts with fatty alkyl esters to give the corresponding N-acyl amino acid salts.

In an aspect, there is provided a process which comprises reacting a fatty alkyl ester with an amino acid salt in the presence of at least 10 mole %, based on the amount of fatty alkyl ester, of an alkoxide catalyst at a pressure of at least 5 psig to produce a composition comprising an N-acyl amino acid salt.

In another aspect, there is provided a process which comprises reacting a C_6-C_{22} methyl ester with a glycinate salt in the presence of at least 10 mole %, based on the amount of C_6-C_{22} methyl ester, of an alkoxide catalyst at a pressure within the range of 5 psig to 30 psig and a temperature within the range of 65°C to 100°C to produce an N-acyl glycinate salt composition.

DETAILED DESCRIPTION OF THE INVENTION

In one inventive process, a fatty alkyl ester reacts with an amino acid salt in the presence of sufficient alkoxide catalyst under pressure to give an N-acyl amino acid salt composition.

Suitable fatty alkyl esters are lower alkyl esters of linear or branched, saturated or unsaturated fatty acids. The fatty alkyl ester can be made, for example, by esterifying a fatty acid with an alkanol or by transesterifying a triglyceride, which is typically an animal or vegetable fat or oil, with an alkanol. Consequently, the fatty portion of the ester will typically have 6-22 carbons with a mixture of saturated and internally unsaturated chains.

In a preferred aspect, the fatty alkyl ester is a lower alkyl ester obtained by fractionation. Thus, saponification of a fat or oil provides a fatty acid, which can be reacted with a lower alkanol to give a mixture of esters, typically methyl esters. Fractionation of this mixture provides fatty alkyl esters having a desired average carbon

We claim:

1. A process which comprises reacting a fatty alkyl ester with an amino acid salt in the presence of at least 10 mole %, based on the amount of fatty alkyl ester, of an alkoxide catalyst at a pressure of at least 5 psig to produce a composition comprising an N-acyl amino acid salt.

2. The process of claim **1** wherein the catalyst comprises a C_1-C_4 alkoxide.

3. The process of claim **1** wherein the catalyst is sodium methoxide/methanol.

4. The process of claim **1** wherein the catalyst is used in an amount within the range of 12 to 50 mole %.

5. The process of claim **1** wherein the reaction is performed at a pressure within the range of 5 psig to 50 psig.

6. The process of claim **1** wherein the fatty alkyl ester is a C_6-C_{22} methyl ester.

7. The process of claim **1** wherein the amino acid salt is an alkali metal salt of an amino acid selected from the group consisting of glycine, alanine, glutamine, glutamic acid, and aspartic acid.

8. The process of claim **1** wherein the amino acid salt is an alkali metal salt of glycine.

9. The process of claim **1** wherein the reaction is performed in the presence of a polyol selected from the group consisting of glycerin and propylene glycol.

10. The process of claim **1** wherein the reaction is performed at a temperature within the range of 65°C to 200°C.

11. The process of claim **1** wherein the reaction is performed in the presence of 1 to 200 wt.%, based on the amount of fatty alkyl ester, of an added alcohol solvent.

12. The process of claim **11** wherein the reaction is performed in the presence of 40 to 80 wt.% of the alcohol solvent.

13. The process of claim **1** wherein conversion of the amino acid salt to the N-acyl amino acid salt is at least 85 mole %.

14. The process of claim **1** wherein a 20 wt.% aqueous solution comprising the N-acyl amino acid salt has an APHA color less than 100.

~~**15.** An N-acyl amino acid salt composition made by the process of claim 1.~~

~~16. The N-acyl amino acid salt composition of claim 15 comprising less than 5 mole % of di-acylated by-products.~~

~~17. An aqueous formulation comprising the N-acyl amino acid salt composition of claim 15 and having at least 20 wt.% actives content of the N-acyl amino acid salt.~~

~~18~~15. The process of claim 1 wherein the N-acyl amino acid salt is isolated from unreacted starting materials in the N-acyl amino acid salt composition by forming a slurry of the composition in a C_1-C_4 alcohol, recovering the N-acyl amino acid salt from the slurry, and drying the N-acyl amino acid salt.

~~19~~16. The process of claim ~~18~~ 15 wherein the C_1-C_4 alcohol is methanol.

~~20~~17. The process of claim ~~18~~ 15 wherein filtration is used to recover the N-acyl amino acid salt, and unreacted starting materials recovered from the resulting filtrate are reused to make additional N-acyl amino acid salt.

~~21. A single-phase mixture comprising a fatty alkyl ester, an amino acid salt, and at least 10 mole %, based on the amount of fatty alkyl ester, of an alkoxide catalyst.~~

~~22. The mixture of claim 21 comprising an amino acid salt mixture, wherein the amino acid salt mixture comprises a glycinate salt and a non-glycinate amino acid salt, and wherein the amino acid salt mixture comprises at least 20 mole % of the glycinate salt.~~

~~23. The mixture of claim 22 wherein the non-glycinate amino acid salt derives from an amino acid selected from the group consisting of valine, proline, glutamine, lysine, and sarcosine.~~

~~24. The mixture of claim 21 comprising an amino acid salt mixture, wherein the amino acid salt mixture comprises a glycinate salt and a non-glycinate amino acid salt, and wherein the amino acid salt mixture comprises at least 30 mole % of the glycinate salt.~~

~~25. The mixture of claim 21 comprising at least a 30 mole % excess of the fatty alkyl ester.~~

~~26. The mixture of claim 21 comprising at least a 30 mole % excess of the amino acid salt.~~

~~27. An N-acyl amino acid salt composition produced by reacting the mixture of claim 21.~~

~~28~~18. The process of claim 1 wherein the amino acid salt is a mixture comprising a glycinate salt and a non-glycinate amino acid salt, wherein the salt mixture comprises at least 20 mole % of the glycinate salt.

~~29~~19. The process of claim 1 wherein the amino acid salt is a mixture comprising a glycinate salt and a non-glycinate amino acid salt, wherein the salt mixture comprises at least 30 mole % of the glycinate salt.

~~30~~20. The process of claim 1 wherein at least a 30 mole % excess of the fatty alkyl ester is used based on the combined amounts of fatty alkyl ester and amino acid salt.

~~31~~21. The process of claim 1 wherein at least a 30 mole % excess of the amino acid salt is used based on the combined amounts of fatty alkyl ester and amino acid salt.

~~32~~22. A process which comprises reacting a C_6-C_{22} methyl ester with a glycinate salt in the presence of at least 10 mole %, based on the amount of C_6-C_{22} methyl ester, of an alkoxide catalyst at a pressure within the range of 5 psig to 30 psig and a temperature within the range of 65°C to 100°C to produce an N-acyl glycinate salt composition.

~~33~~23. The process of claim ~~32~~ 22 wherein the N-acyl glycinate salt composition has an APHA color less than 20 and comprises 5 mole % or less of fatty acid soap and 1 mole % or less of di-acylated by-products.