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(54) Title: DISPERSION OF TRIGLYCERIDES

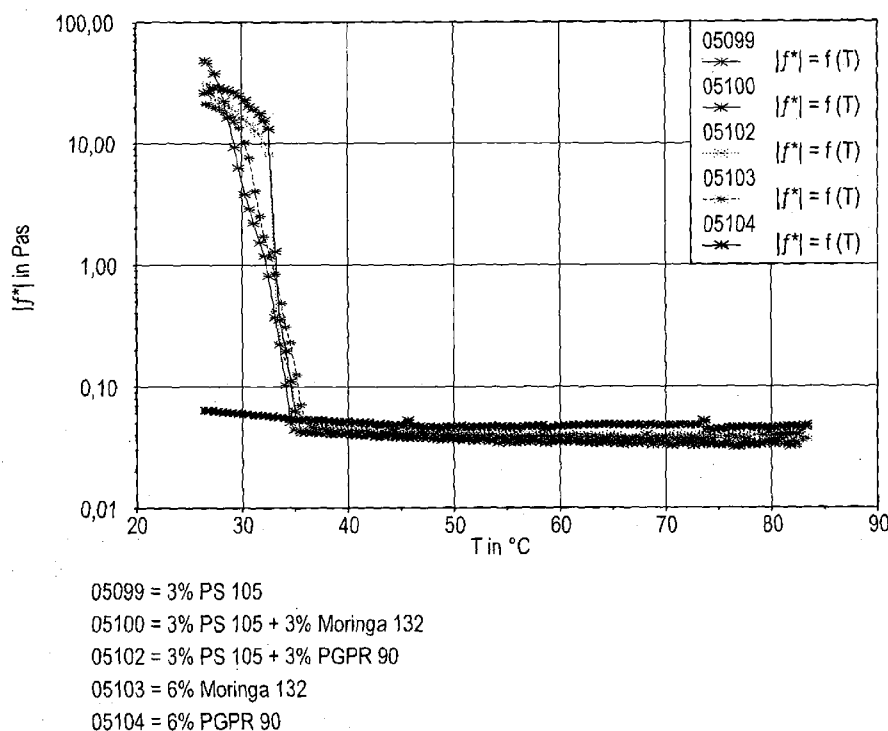


FIG. 1

(57) Abstract: The present invention provides a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil.



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DISPERSION OF TRIGLYCERIDES

FIELD OF INVENTION

- 5 The present invention relates to a dispersion of two triglycerides. In particular, the present invention relates to dispersion which may be consumed as a food or feed or which may be an ingredient in a food or feed.

BACKGROUND

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Dispersions consist of a stable mixture of two materials which are different to each other and in which small droplets or particles of one phase or material are dispersed uniformly throughout the other phase/material. A typical dispersion is a triglyceride dispersion in which a solid fat phase provides one of the continuous or dispersed phases and a liquid
15 oil phase provides the other of the continuous or dispersed phases. Dispersions may be edible dispersions such as a liquid bread improver, a nut butter or shortening.

Dispersions are typically stabilised by the addition of a surfactant and many effective surfactants are known. Many frequently used surfactants are mono or di esters of fatty
20 acids and glycerol. However, providing a source of suitable fatty acids can be problematic. Fatty acids are typically provided from triglycerides and these are sourced from triglycerides oils of natural sources. Many well known sources of oils are plants, animals and fish. However, there is an increasing demand for certain of these oils, and many oils are becoming unacceptable to consumers for ethical or health reasons. There
25 is therefore a desire to provide monoglycerides prepared from source oils which are easily grown, not in high demand, are ethically acceptable and which have a fatty acid profile which provides for an effective emulsifier.

In view of the above, it would be desirable to produce a food or feed dispersion
30 containing a surfactant which has effective surfactant properties and which is sourced in a manner acceptable to consumers..

SUMMARY ASPECTS OF THE PRESENT INVENTION

In one aspect, the present invention provides a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil.

In one aspect, the present invention provides a process for preparing a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil, the process comprising the steps of

(a) contacting

(i) a first triglyceride; and

(ii) a second triglyceride;

wherein the first triglyceride and second triglyceride are different

(b) forming a dispersion wherein the first triglyceride provides a continuous phase and wherein the second triglyceride provides a dispersed phase; and

(c) contacting the first triglyceride and the second triglyceride either before step (b) or after step (b) with a mono or di ester of glycerol and Moringa oil.

In one aspect, the present invention provides use of a mono or di ester of glycerol and Moringa oil to prepare or stabilise a dispersion comprising (i) a triglyceride continuous phase; and (ii) a triglyceride dispersed phase.

It has been surprisingly found that oil from plants from the genus *Moringa* may be used in the preparation of mono or di esters of glycerol, commonly known to one skilled in the art as mono and di glycerides, which may be effective surfactant for use in food or feed. The *Moringa* plant is particularly advantageous as a source of oil to prepare the mono and di glycerides because the plant has been known as a source of edible materials for many years. Therefore the oil obtained from the plant may be regarded as safe for consumption. The use of mono and di glycerides prepared from *Moringa* oil has not previously been taught.

Moringa is the sole genus in the flowering plant family Moringaceae. The 13 species it contains are from tropical and subtropical climates and range in size from tiny herbs to very large trees. *Moringa* may therefore be grown in many climates in which cash crops may not currently be cultivated. *Moringa* cultivation is promoted as a means to combat poverty and malnutrition and the plant grows quickly in many types of environments. The

seeds contain 30-50% oil and may produce 100-200 gal/acre/year. Moringa species are drought-resistant and can grow in a wide variety of poor soils, even barren ground, with soil pH between 4.5 and 9.0.

5 DETAILED DESCRIPTION

As discussed above, in one aspect, the present invention provides a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil.

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Moringa

It will be appreciated by one skilled in the art that the term 'Moringa' refers to the sole genus in the flowering plant family Moringaceae.

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As discussed in Pandey A., Pradheep, K., Gupta, R., Roshini Nayar, E., Bhandari, D.C., (2010) Drumstick tree, *Moringa oleifera* Lam, a multipurpose potential species in India, Genetic Resources and Crop Evolution, Springer, the genus *Moringa* Adans. (family Moringaceae) has more than 13 species (Verdcourt 1985), of which two species viz. *M. oleifera* Lam. (syn. *M. pterygosperma* Gaertn.) and *M. concanensis* Nimmo occur in India. *M. oleifera* (the drumstick tree, horse radish tree, West Indian Ben) is a fast-growing, medium sized and drought-resistant tree distributed in the sub-Himalayan tracts of northern India (Singh et al. 2000; Hsu et al. 2006). The species of *Moringa* are further discussed in Bennet, R.N., Mellon, F.A., Foidl, N., Pratt, J.H., DuPont, M.S., Perkins, L., and Kroon, P.A. (2003) "Profiling gluconsinolates and phenolics in vegetative and reproductive tissues of the multi-purpose trees, *Moringa oleifera* L. (horseradish tree) and *Moringa stenopetalia* L." *Journal of Agricultural and Food Chemistry* 51(12) 3546-3553. *M. oleifera* (locally called shobhanjana, murungai, soanjna, shajna, sainjna) is considered to be the best known and widely distributed tree species among the genus (Morton 1991; Fuglie 1999). This is the only species in this genus which has been accorded some research and development at the world level.

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For completeness, the current known species of the plant family Moringaceae are *Moringa arborea* Verdc. (Kenya), *Moringa borziana* Mattei, *Moringa concanensis* Nimmo, *Moringa drouhardii* Jum. – *Bottle Tree* (southwestern Madagascar), *Moringa hildebrandtii* Engl. – *Hildebrandt's Moringa* (southwestern Madagascar), *Moringa longituba* Engl.,

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Moringa oleifera Lam. (syn. *M. pterygosperma*) – Horseradish Tree (northwestern India), *Moringa ovalifolia* Dinter & Berger, *Moringa peregrina* (Forssk.) Fiori, *Moringa pygmaea* Verdc., *Moringa ruspoliana* Engl., *Moringa rivaie* (Kenya, Ethiopia and Somalia) and *Moringa stenopetala* (Baker f.) Cufod.

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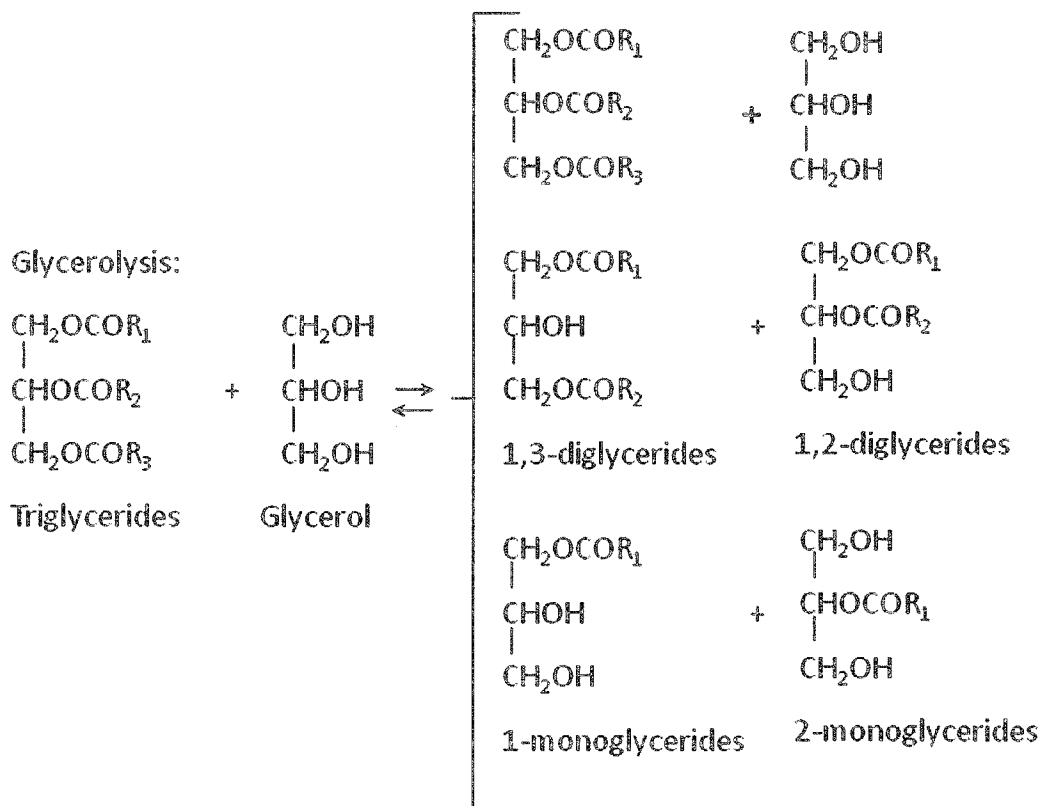
In a preferred aspect the Moringa is a plant of the species *Moringa oleifera*.

Mono or Di Ester Of Glycerol And Moringa Oil

10 The process for making mono or di esters of fatty acids and glycerol, in other words mono and diglycerides and the process for making distilled monoglycerides are well known to the person skilled in the art. For example information can be found in "Emulsifiers in Food Technology", Blackwell Publishing, edited by R. J. Whitehurst, page 40-58.

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Mono- and diglycerides are generally produced by interesterification (glycerolysis) of triglycerides with glycerol, see fig. below:



Triglycerides react with glycerol at high temperature (200-250°C) under alkaline conditions, yielding a mixture of monoglycerides, diglycerides and triglycerides as well as unreacted glycerol. The content of monoglycerides varies typically from 10-60% depending on the glycerol/fat ratio. Alternatively mono- and diglycerides may also be prepared via direct esterification of glycerol with a fatty acid mixture.

If glycerol is removed from the mixture above by e.g. distillation, the resulting mixture of monoglycerides, diglycerides and triglycerides is often sold as a "mono-diglyceride" and used as such. Distilled monoglyceride may be separated from the mono-diglyceride by molecular or short path distillation.

Dispersion

As discussed above, the dispersion comprises (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil. In one aspect the triglyceride continuous phase is a solid triglyceride. In one aspect the triglyceride continuous phase is a liquid triglyceride. In one aspect the triglyceride dispersed phase is a solid triglyceride. In one aspect the triglyceride dispersed phase is a liquid triglyceride.

Preferably the triglyceride continuous phase is selected from hard or soft oils. Preferably the triglyceride continuous phase is selected from palm oil, rape seed oil, sunflower oil, fish oils, soybean oils, coconut oils, ricebran oils, dag oils, beef tallow, allanblackia oils and shea fat.

Preferably the triglyceride dispersed phase is selected from hard or soft oils. Preferably the triglyceride dispersed phase is selected from palm oil, rape seed oil, sunflower oil, fish oils, soybean oils, coconut oils, ricebran oils, dag oils, beef tallow, allanblackia oils and shea fat.

In one aspect the triglyceride dispersed phase is selected from bio-reactor derived algae oils. These materials may be used in dispersion preferably for non-human feed.

It will be appreciated by one skilled in the art that a dispersion which contains a triglyceride does not typically contain water. If water is present and the dispersion contains a dispersed phase and a continuous phase, one of which is triglyceride and one

of which is water, this is typically referred to as an emulsion. Thus in one aspect the dispersion is free of water. By free of water it is meant the dispersion contains water in an amount of less than 1 wt.% based on the total dispersion. Preferably the dispersion contains water in an amount of less than 0.8 wt.% based on the total dispersion, such as
5 in an amount of less than 0.6 wt.% based on the total dispersion, such as in an amount of less than 0.5 wt.% based on the total dispersion, such as in an amount of less than 0.4 wt.% based on the total dispersion, such as in an amount of less than 0.3 wt.% based on the total dispersion, such as in an amount of less than 0.2 wt.% based on the total dispersion, such as in an amount of less than 0.1 wt.% based on the total dispersion,
10 such as in an amount of less than 0.05 wt.% based on the total dispersion, such as in an amount of less than 0.02 wt.% based on the total dispersion, such as in an amount of less than 0.01 wt.% based on the total dispersion, such as in an amount of less than 0.001 wt.% based on the total dispersion, such as in an amount of less than 0.0001 wt.% based on the total dispersion.

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The dispersion of the present invention may be a food or feed. In one alternative the dispersion of the present invention may be a food additive or food ingredient suitable for addition to a foodstuff to provide a food or feed.

20 Usage

The mono or di ester of glycerol and Moringa oil may be provided in the dispersion in the desired amount to achieve the desired function of the mono or di ester of glycerol and Moringa oil. If the dispersion is a food or feed or is added to a food or feed, the mono or
25 di ester of glycerol and Moringa oil may be provided in the dispersion in the desired amount to achieved the desired function of the mono or di ester of glycerol and Moringa oil in the dispersion or in the food or feed to which the dispersion is added.

In one embodiment, mono or di ester of glycerol and Moringa oil is present in the
30 dispersion in an amount of at least about 0.01% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 0.02% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 0.05% w/w based on the total weight of the
35 dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 0.1% w/w based on the total weight of the

dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 0.2% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 0.5% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 1.0% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 2.0% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 3.0% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 5.0% w/w based on the total weight of the dispersion. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the dispersion in an amount of at least about 10.0% w/w based on the total weight of the dispersion.

In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.01% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.02% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.05% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.1% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.2% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 0.5% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 1.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 1.2% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of at least about 1.5% w/w based on the total weight of the food or feed.

In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.01 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.02 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.05 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.1 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.2 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.5 to about 2.0% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.5 to about 1.5% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 0.8 to about 1.5% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 1.0 to about 1.5% w/w based on the total weight of the food or feed. In one embodiment, mono or di ester of glycerol and Moringa oil is present in the food or feed in an amount of from about 1.0 to about 1.2% w/w based on the total weight of the food or feed.

Food or Feed

In addition to providing a dispersion containing a mono or di ester of glycerol and Moringa oil, the present invention provides a process for preparing the dispersion. In one aspect, the present invention provides a process for preparing a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil, the process comprising the steps of

- (a) contacting
 - (i) a first triglyceride; and
 - (ii) a second triglyceride;

wherein the first triglyceride and second triglyceride are different

(b) forming a dispersion wherein the first triglyceride provides a continuous phase and wherein the second triglyceride provides a dispersed phase; and
(c) contacting the first triglyceride and the second triglyceride either before step (b) or after step (b) with a mono or di ester of glycerol and Moringa oil.

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In addition to providing a food or feed containing the dispersion of the present invention, the present invention provides a process for preparing the food or feed containing the dispersion. Thus there is provided a process for preparing a food or feed comprising as defined herein, comprising the steps of contacting (a) a foodstuff and (b) a dispersion
10 comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil. In a further aspect, the present invention provides use of a dispersion comprising (i) a triglyceride continuous phase; (ii) a triglyceride dispersed phase; and (iii) a mono or di ester of glycerol and Moringa oil to prepare a food or feed.

15

According to the present invention, "food" refers to an edible material suitable for human consumption. According to the present invention, "feed" refers to an edible material suitable for non-human animal consumption.

20 In one aspect the food or feed is a food. In one aspect the food or feed is a feed.

The foodstuff may be solid or liquid. In some cases, the foodstuff may transform during cooking from a solid to a liquid. Furthermore, foodstuffs comprising a combination of liquid and solid components are also encompassed by the present invention.

25

Examples of foodstuffs in which the present invention may be employed include, but are not limited to tahini(a), ghee, vanaspati, peanut butter and peanut paste, praline and hazelnut spread.

30 The dispersion of the present invention may be a food selected from, or may be a food additive or food ingredient to be added to a food selected from, nut butters, seed butters, shortenings and liquid bread improvers. In one aspect the nut butter or seed butter is selected from almond butter, cashew butter, hazelnut butter, macadamia nut butter, peanut butter, pecan butter, pistachio butter, walnut butter, pumpkin seed butter, sesame
35 seed butter (tahini), soybean butter and sunflower seed butter.

In one aspect the dispersion is a food suitable for human consumption. Preferably the food is selected from candy bars, whipable fillings, protein drinks, beverage whiteners, milk shake concentrates and savoury flavourings.

- 5 In one aspect the dispersion is a feed suitable for animal consumption. Preferably the feed is selected from poultry feed, aqua culture feed, bovine feed and porcine feed. A preferred feed is a feed pellet for fish.

10 In one embodiment, the food additive or food ingredient may be added to foodstuff selected from the group consisting of spreads, bakery margarine, cake margarine, chocolate, compound chocolate, ice cream, liquid bread improvers. More preferably the foodstuff is selected from chocolate and compound chocolate. In one preferred aspect the foodstuff is selected from whipped frozen desserts. A particularly preferred_whipped frozen dessert is an ice cream.

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In one embodiment, the food or feed is selected from a combination of one or more foodstuffs.

Monoglyceride of Saturated Fatty Acid

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The present inventors have further identified that the presence of a monoglyceride of a saturated C16 to C26 fatty acid may be advantageous to the effects achieved in the dispersion of the present invention. Thus in a further aspect, the present invention further provides

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- a dispersion comprising
 - (i) a triglyceride continuous phase;
 - (ii) a triglyceride dispersed phase;
 - (iii) a mono or di ester of glycerol and Moringa oil; and
 - 30 (iv) a monoglyceride of a saturated C16 to C26 fatty acid.
- a process for preparing a dispersion comprising
 - (i) a triglyceride continuous phase;
 - (ii) a triglyceride dispersed phase;
 - 35 (iii) a mono or di ester of glycerol and Moringa oil; and
 - (iv) a monoglyceride of a saturated C16 to C26 fatty acid

the process comprising the steps of

(a) contacting

(i) a first triglyceride; and

(ii) a second triglyceride;

5 wherein the first triglyceride and second triglyceride are different

(b) forming a dispersion wherein the first triglyceride provides a continuous phase and wherein the second triglyceride provides a dispersed phase; and

(c) contacting the first triglyceride and the second triglyceride either before step (b) or after step (b) with a mono or di ester of glycerol and Moringa oil and with a

10 monoglyceride of a saturated C16 to C26 fatty acid.

- use of a mono or di ester of glycerol and Moringa oil and a monoglyceride of a saturated C16 to C26 fatty acid to prepare or stabilise a dispersion comprising (i) a triglyceride continuous phase; and (ii) a triglyceride dispersed phase.

15

The saturated fatty acid of the monoglyceride may have a carbon chain length of from 16 to 26 carbon atoms. In one aspect the saturated fatty acid of the monoglyceride may have a carbon chain length of from 16 to 24 carbon atoms. In one aspect the saturated fatty acid of the monoglyceride may have a carbon chain length of from 16 to 22 carbon
20 atoms. In one aspect the saturated fatty acid of the monoglyceride may have a carbon chain length of from 18 to 22 carbon atoms. In one aspect the saturated fatty acid is C16 saturated fatty acid. In one aspect the saturated fatty acid is C18 saturated fatty acid. In one aspect the saturated fatty acid is C20 saturated fatty acid. In one aspect the saturated fatty acid is C22 saturated fatty acid. In one aspect the saturated fatty acid is
25 C24 saturated fatty acid. In one aspect the saturated fatty acid is C26 saturated fatty acid.

Preferably the saturated fatty acid of the monoglyceride has a carbon chain length of from 18 to 22 carbon atoms. Preferably the saturated fatty acid of the monoglyceride has a carbon chain length of 18 carbon atoms. Preferably the saturated fatty acid of the
30 monoglyceride has a carbon chain length of 22 carbon atoms.

In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 0.01% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid
35 is present in the dispersion in an amount of at least about 0.02% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to

C26 fatty acid is present in the dispersion in an amount of at least about 0.05% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 0.1% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 0.2% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 0.5% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 1.0% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 2.0% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 3.0% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 5.0% w/w based on the total weight of the dispersion. In one embodiment, the monoglyceride of a saturated C16 to C26 fatty acid is present in the dispersion in an amount of at least about 10.0% w/w based on the total weight of the dispersion.

Polyglycerol Polyricinoleic Acid (PGPR)

The present inventors have identified that the mono or di ester of glycerol and Moringa oil has a significant number of emulsifying properties similar to that of polyglycerol polyricinoleic acid. These are discussed in detail herein. Therefore in aspects of the invention the present emulsifier may be used to replace PGPR in applications where PGPR is typically used. This replacement may be complete replacement or partial replacement. In respect of partial replacement, in that aspect the present invention provides a food or feed as defined herein further comprising polyglycerol polyricinoleic acid. In other words, the present invention provides a food or feed comprising (i) a foodstuff; (ii) an emulsifier composition comprising (a) polyglycerol polyricinoleic acid, and (b) a mono or di ester of glycerol and Moringa oil. Indeed, one skilled in the art will appreciate that the present emulsifier and the PGPR may be provided as an emulsifier composition for use in the preparation of emulsions. Thus, in one aspect, the present

invention provides an emulsifier composition comprising (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil.

The use of Moringa monoglycerides in food applications could lead to significant benefits for the customer if these monoglycerides can be used to partially or completely replace polyglycerol polyricinoleic acid (PGPR) based products. Such benefits would likely include; improved production yield (attributed to less down time), allow re-work to occur more easily, and potentially enable the removal of E476 from labelling. It is not clear which of these benefits is most attractive to the customer, but each represents a significant advantage.

Mono or di ester of glycerol and Moringa oil may be prepared at concentrations which are suitable for use in foodstuffs according to recommended daily guidelines.

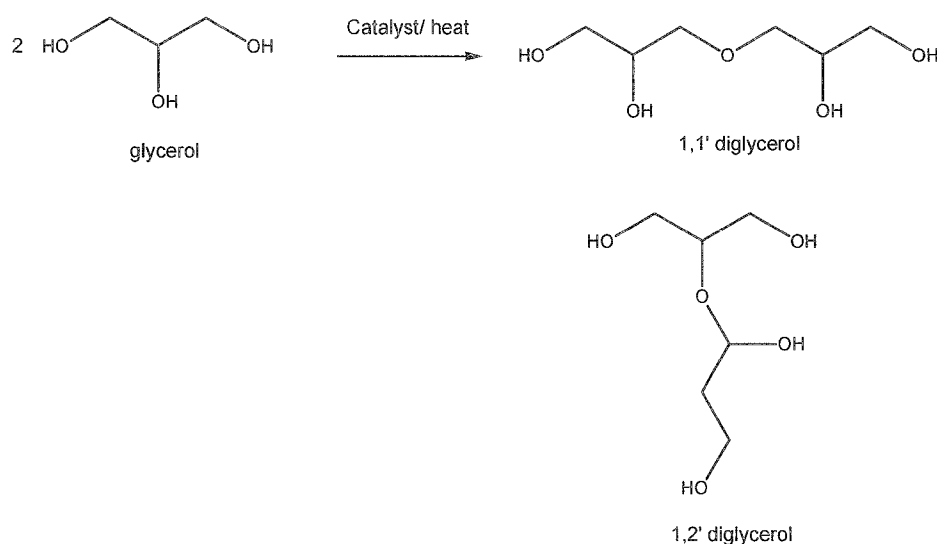
Alternatively, they may be prepared at higher concentrations and subsequently diluted to a concentration which is suitable for use in foodstuffs according to recommended daily guidelines. Where the composition is prepared at the higher concentration, the composition may comprise (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 10wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 20wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 30wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 40wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 50 wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 60 wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 70wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 80wt. %. In one embodiment, the composition comprises (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil in a combined amount of at least 90wt. %. In one embodiment, the composition consists

essentially of (a) polyglycerol polyricinoleic acid; and (b) a mono or di ester of glycerol and Moringa oil.

In this regard, "consisting essentially of" is defined herein as meaning that in addition to the components which are recited, other components may also be present in the composition, provided that the essential characteristics of the composition are not materially affected by their presence.

Polyglycerols

Polyglycerols are substances consisting of oligomer ethers of glycerol. Polyglycerols are usually prepared from an alkaline polymerisation of glycerol at elevated temperatures.



Scheme 1 - Overview of the production of polyglycerols

The processes for making polyglycerols are well known to the person skilled in the art and can be found, for example, in "Emulsifiers in Food Technology", Blackwell Publishing, edited by RJ Whithurst, page 110 to 130.

It will be understood that the degree of polymerisation can vary. It will be understood that polyglycerol is typically a mixture of polyglycerols of varying degrees of polymerisation. In one embodiment, the polyglycerol used to form the polyglycerol ester of a polymerised fatty acid is a mixture of polyglycerols selected from diglycerol, triglycerol, tetraglycerol, pentaglycerol, hexaglycerol, heptaglycerol, octaglycerol, nonaglycerol and decaglycerol. In one preferred embodiment triglycerol is the most

abundant polyglycerol in the mixture of polyglycerols. In one preferred embodiment tetraglycerol is the most abundant polyglycerol in the mixture of polyglycerols. In one preferred embodiment the mixture of polyglycerols contains triglycerol in an amount of 30-50 wt.% based on the total weight of polyglycerols and contains tetraglycerol in an amount of 10-30 wt.% based on the total weight of polyglycerols.

In one embodiment, the polyglycerol is considered to be a diglycerol. In one embodiment, the polyglycerol is considered to be a triglycerol. In one embodiment, the polyglycerol is considered to be a tetraglycerol. In one embodiment, the polyglycerol is considered to be a pentaglycerol. In one embodiment, the polyglycerol is considered to be a hexaglycerol. In one embodiment, the polyglycerol is considered to be a heptaglycerol. In one embodiment, the polyglycerol is considered to be an octaglycerol. In one embodiment, the polyglycerol is considered to be a nonaglycerol. In one embodiment, the polyglycerol is considered to be a decaglycerol.

Preferably the polyglycerol is considered to be a triglycerol. Preferably the polyglycerol is considered to be a tetraglycerol.

In one embodiment, the polyglycerol moiety shall be composed of not less than 75% of di-, tri- and tetraglycerols and shall contain no more than 10% of polyglycerols equal to or higher than heptaglycerol.

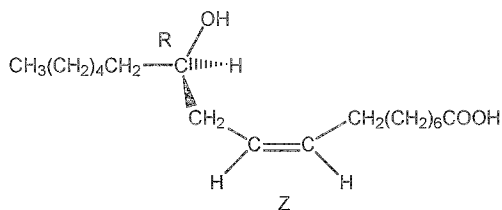
Polyglycerols may be linear, branched or cyclic in structure. Typically, all three types of polyglycerol structure are present in the composition of the present invention.

Fatty acids

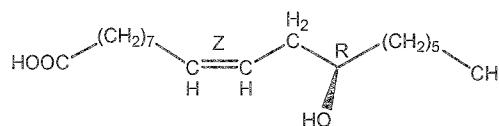
Fatty acids are well known in the art. They typically comprise an "acid moiety" and a "fatty chain". The properties of the fatty acid can vary depending on the length of the fatty chain, its degree of saturation, and the presence of any substituents on the fatty chain. Examples of fatty acids are palmitic acid, stearic acid, oleic acid, and ricinoleic acid.

The fatty acid used according to this aspect of the present invention is ricinoleic acid.

Ricinoleic acid is a chiral molecule. Two steric representations of ricinoleic acid are given below:



Ricinoleic acid
(R)-12-hydroxy-(Z)-9-octadecenoic acid



Ricinoleic acid
(R)-12-hydroxy-(Z)-9-octadecenoic acid

5

Scheme 2 - Configurations of ricinoleic acid.

The ricinoleic acid used in the present invention may be prepared by any suitable means known to the person skilled in the art. Typically, fatty acids are produced from a parent oil via hydrolyzation and distillation.

10

BRIEF DESCRIPTION OF FIGURES

Figures 1 to 7 show graphs.

15

EXAMPLES

The present invention will now be defined with reference to the following non-limiting examples.

20

EXAMPLE 1 - Preparation of Moringa monoglycerides

The Moringa monoglyceride and distilled Moringa monoglyceride were prepared in several batches in accordance with the processes described below.

25

2472/173: Mono-diglyceride based on moringa oil. Interesterification.

(Mono-diglyceride 173; Moringa Mono-diglyceride 173; Moringa 173; MM 173)

Refined moringa oil (Code: 126089, Batch Nr: DEO5040243, EO Ref: SO4903823/1, from Earth Oil Plantations Limited). 2550g. The moringa oil was extracted from *Moringa oleifera* (also known as *Moringa pterygosperma*).

30

Glycerol 625g.

1.300g 50% solution of NaOH.

Above ingredients were charged to a 5L 3-necked round bottomed flask, with
5 mechanical stirring, heating mantel with temperature control, nitrogen blanketing, condenser, in a set-up analogous to the below example:

The temperature was raised to 240°C under stirring and nitrogen blanketing. The mixture was heated at 240°C until it became clear. When clear, the mixture was heated
10 for further 30 min.

The mixture was then neutralised with 1.25g H_3PO_4 (85%) at 240°C. After neutralisation the mixture was cooled to about 90°C.

The mixture was deodorised in order to remove the free glycerol. The set-up around the 3-
15 necked flask was therefore changed to look like the below example of a deodorisation set-up:

Water vapours were introduced to the mixture via a glass tube at the bottom of the 3 necked flask below surface level of the mixture, a cold trap cooled by acetone/ CO_2 bath was used and connected to a vacuum pump.

20

At 90°C full vacuum (<0,5 mm Hg) was supplied to the set-up from the vacuum pump. This causes thorough mixing of the product mixture. Then the mixture was heated to 140°C and kept at this temperature for 30 min. Water vapours were passing through the mixture thereby removing free glycerol which was condensed on the cold trap and
25 collected in the receiver flask.

After 30 min the product was cooled to 90° and pressure equalised with nitrogen.

Optionally the filtered mono-diglyceride can be protected with antioxidants if the mono-diglyceride is the end product. Antioxidants were added and the mixture stirred for 15-30
30 min under nitrogen blanketing at 80-90°C.

Yield 2870g.

The mono-diglyceride was filtered through filteraid (Clarcell) and paper filter (AGF 165-110).

35

2472/191: Distilled monoglyceride based on moringa oil.

(Mono-diglyceride 191; Moringa Mono-diglyceride 191; Moringa 191; MM 191)

Mono-diglyceride (2472/173) 2480g.

5

The mono-diglyceride was distilled on a short path distillation apparatus.

The distillation temperature was 210°C.

Reservoir temp. before heated surface 85°C.

10 Condenser was 85°C.

Rotor speed 302 rpm.

Pressure: 1×10^{-3} mBar

Distillate 1373g

Residue 1107g

15 Time 212 min.

Flow: 701 g/h

The distillate was added antioxidant Grindox 349 0,68g.

20 Analysis of the distilled monoglyceride determined by GC:

	%
Glycerol	0.76
Diglycerol	0.07
Monoglyceride	91.15
Diglyceride	7.75
Triglyceride	0.00

Table 1: composition of monoglyceride based on moringa oil

The fatty acid composition of both the starting material, moringa oil, and the resulting monoglyceride was also analysed:

25

	Triglyceride (moringa oil)	Monoglyceride 2472/191
C12	0,2	<0,1
C14	0,1	0,1
C15	<0,1	<0,1
C16	5,9	6,5
C16:1	1,8	1,8
C18	5,5	5,8
C18:1	71,8	71,2
C18:2	1,6	1,5
C18:3	0	0,3
C20	3,3	3,4
C20:1	1,9	1,9
C22	6,3	6,0
C24	1,0	0,8

Table 2: Fatty acid composition of moringa oil and the resulting monoglyceride.

This analysis was done in order to confirm that the fatty acid composition of the
 5 monoglyceride had not changed too much from the starting material.

Moringa oil contains 10-12% of saturated fatty acids above C18. In order to keep these
 high melting fatty acids in the distilled monoglyceride the distillation temperature had to
 be chosen sufficiently high such that these at least were distilled. As can be seen from
 10 the above table this was accomplished. Transferring the highest boiling monoglyceride
 components however results in the monoglyceride as such having a higher content of
 diglyceride than is usually seen with distilled monoglycerides, but that is merely a
 consequence of the broad fatty acid composition in the moringa oil, and that the heavier
 monoglycerides were prioritised due to their also higher melting points.

15

2559/102: Mono-diglyceride based on moringa oil. Interesterification.

(Mono-diglyceride 102; Moringa Mono-diglyceride 102; Moringa 102; MM 102)

Refined moringa oil (Code: 126089, Batch Nr: DEO5040243, EO Ref: SO4903823/1,
 20 from Earth Oil Plantations Limited). **2072g.**
 Glycerol **518g**

1.082g 50% solution of NaOH

The experiment was carried out as for above interesterification (2472/173).

- 5 After the interesterification, the mixture was neutralised with 1.04g H_3PO_4 (85%) at 240°C. After neutralisation the mixture was cooled to about 90°C and the mixture was deodorised and filtered as for above interesterification (2472/173).

Yield: 2313g.

10

Analysis of mono-diglyceride:

	%
Glycerol	0.11
Diglycerol	0.05
Free fatty acids	0.2
Monoglyceride	53.16
Diglyceride	42.05
Triglyceride	4.39

Table 3: Composition of mono-diglyceride based on moringa oil

2559/103: Mono-diglyceride based on moringa oil. Interesterification

- 15 **(Mono-diglyceride 103; Moringa Mono-diglyceride 103; Moringa 103; MM 103)**
(repetition of 2559/102)

Refined moringa oil (Code: 126089, Batch Nr: DEO5040243, EO Ref: SO4903823/1, from Earth Oil Plantations Limited). **2146g.**

- 20 Glycerol **537g**

1.110g 50% solution of NaOH

The experiment was carried out as for above interesterification (2472/173).

- 25 After the interesterification, the mixture was neutralised with 1.07g H_3PO_4 (85%) at 240°C. After neutralisation the mixture was cooled to about 90°C and the mixture was deodorised and filtered as for above interesterification (2472/173).

Yield: 2412g.

Analysis of mono-diglyceride:

	%
Glycerol	0.16
Diglycerol	0.02
Free fatty acids	0.3
Monoglyceride	54.85
Diglyceride	39.59
Triglyceride	5.06

Table 4: Composition of mono-diglyceride based on moringa oil

5

2559/104: Distilled monoglyceride based on moringa oil.

(Mono-diglyceride 104; Moringa Mono-diglyceride 104; Moringa 104; MM 104)

The mono-diglyceride was distilled on a short path distillation apparatus as above

10 (2472/191).

Mono-diglyceride (2559/102) + (2559/103) were both distilled.

The distillation temperature was 200-210°C.

Reservoir temp. before heated surface 85°C.

15 Condenser was 90°C.

Rotor speed 297 rpm.

Pressure: $4-5 \times 10^{-3}$ mBar

Distillate 2245g

Residue 1819g

20 Time 360 min.

Flow: 677 g/h

Analysis of distilled monoglyceride determined by GC:

	%
Glycerol	1.27
Diglycerol	0.08
Free fatty acids	0.4
Monoglyceride	82.55

Diglyceride	15.67
Triglyceride	0.02

Table 5: Composition of monoglyceride based on moringa oil

2559/105: Distilled monoglyceride above based on moringa oil with added antioxidant.

- 5 (Mono-diglyceride 105; Moringa Mono-diglyceride 105; Moringa 105; MM 105)

2559/104: 2245g

Grindox 349: 1.12g

- 10 2559/132: Distilled monoglyceride based on moringa oil.

(Mono-diglyceride 132; Moringa Mono-diglyceride 132; Moringa 132; MM 132)

Mono-diglyceride prepared analogously to above mono-diglycerides (2472/173) and with the following analysis was used as raw material for the distillation.

	%
Glycerol	0.16
Diglycerol	0.13
Free fatty acids	0.2
Monoglyceride	55.39
Diglyceride	39.50
Triglyceride	4.65

- 15 Table 6: Composition of mono-diglyceride used as raw material for distillation.

The mono-diglyceride was distilled on a short path distillation apparatus as above (2472/191).

- 20 The distillation temperature was 210°C.

Reservoir temp. before heated surface 85°C.

Condenser was 85°C.

Rotor speed 297 rpm.

Pressure: $1-2 \times 10^{-3}$ mBar

- 25 Distillate 1506g

Residue 1092g

Time 211 min.

Flow: 739 g/h

Analysis of distilled monoglyceride determined by GC:

	%
Glycerol	0.88
Diglycerol	0.15
Free fatty acids	0.2
Monoglyceride	86.92
Diglyceride	11.80
Triglyceride	0.03

5 Table 7: Composition of monoglyceride based on moringa oil

2559/134: Distilled monoglyceride based on moringa oil.

(Mono-diglyceride 134; Moringa Mono-diglyceride 134; Moringa 134; MM 134)

- 10 Mono-diglyceride prepared analogously to above mono-diglycerides (2472/173) and with the following analysis was used as raw material for the distillation.

	%
Glycerol	0.49
Diglycerol	0.11
Free fatty acids	0.2
Monoglyceride	54.51
Diglyceride	39.78
Triglyceride	4.92

Table 8: Composition of mono-diglyceride used as raw material for distillation.

- 15 The mono-diglyceride was distilled on a short path distillation apparatus as above (2472/191).

The distillation temperature was 185°C.

Reservoir temp. before heated surface 85°C.

Condenser was 85°C.

- 20 Rotor speed 290 rpm.

Pressure: $1-2 \times 10^{-3}$ mBar

Distillate 1407g

Residue 1444g

Time 223 min.

Flow: 767 g/h

5

Analysis of distilled monoglyceride determined by GC:

	%
Glycerol	0.52
Diglycerol	0.22
Free fatty acids	0.2
Monoglyceride	97.98
Diglyceride	1.06
Triglyceride	0.02

Table 9: Composition of monoglyceride based on moringa oil.

A summary of the analyses of samples 2559/132 and 2559/134 is given in Table 10

10 below.

	Monoglyceride	Monoglyceride	Triglyceride
	2559/132	2559/134	starting material
Distillation °C	210°C	185°C	
GL	0.88	0.52	
DIGL	0.15	0.22	
FFA	0.2	0.2	
MONO	86.92	97.95	
DI	11.80	1.06	
TRI	0.03	0.02	
C12	<0.1	<0.1	0.2
C14	0.1	0.1	0.1
C16	6.3	6.4	5.9
C16:1	1.9	1.9	1.8
C17	0.1	0.1	0.1
C18	5.5	5.7	5.5
C18:1	72.6	75.3	71.8
C18:2	1.5	1.5	1.6
C18:3	0.2	0.2	0.0
C20	3.2	2.9	3.3
C20:1	1.8	1.7	1.9
C20:u	0.2	0.2	0.1
C21	<0.1	0.0	

C22	5.8	3.6	6.3
C22:1	0.1	0.0	0.1
C23	<0.1	<0.1	1.0
C24	0.8	0.3	0.1

Table 10

2461/206: Mono-diglyceride based on moringa oil. Interesterification.

- 5 Refined moringa oil (Code: 126089, Batch Nr: DEO5040243, EO Ref: SO4903823/1, from Earth Oil Plantations Limited). **3000g**.

Glycerol **750g**

1.08g 50% solution of NaOH

- 10 The experiment was carried out as for above interesterification (2472/173).

After the interesterification, the mixture was neutralised with **5.65g** H_3PO_4 (10%) in glycerol at 240°C. After neutralisation the mixture was cooled to about 90°C and the mixture was deodorised and filtered as for above interesterification (2472/173).

15

Yield: 3751g.

Analysis of mono-diglyceride:

	%
Glycerol	0.2
Diglycerol	<0.1
Free fatty acids	0.2
Monoglyceride	54.0
Diglyceride	40.5
Triglyceride	5.1

Table 3: Composition of mono-diglyceride based on moringa oil

20

2461/207: Mono-diglyceride based on moringa oil. Interesterification
(repetition of 2461/206)

- 25 Refined moringa oil (Code: 126089, Batch Nr: DEO5040243, EO Ref: SO4903823/1, from Earth Oil Plantations Limited). **3000g**.

Glycerol 750g

1.08g 50% solution of NaOH

The experiment was carried out as for above interesterification (2472/173).

5

After the interesterification, the mixture was neutralised with 5.65g H_3PO_4 (10%) in glycerol at 240°C. After neutralisation the mixture was cooled to about 90°C and the mixture was deodorised and filtered as for above interesterification (2472/173).

10 Yield: 3751g.

Analysis of mono-diglyceride:

	%
Glycerol	0.5
Diglycerol	<0.1
Free fatty acids	0.3
Monoglyceride	52.0
Diglyceride	41.9
Triglyceride	5.3

Table 4: Composition of mono-diglyceride based on moringa oil

15 **2461/208: Distilled monoglyceride based on moringa oil.**

The mono-diglycerides 2461/206 + 2461/208 was distilled on a short path distillation apparatus as above (2472/191).

20 The distillation temperature was 210°C.

Reservoir temp. before heated surface 85°C.

Condenser was 80°C.

Rotor speed 300 rpm.

Pressure: 2×10^{-3} mBar

25 Distillate 3750g

Residue 2711g

Time 540 min.

Flow: 718 g/h

Analysis of distilled monoglyceride determined by GC:

	%
Glycerol	1.2
Diglycerol	0.1
Free fatty acids	0.1
Monoglyceride	83.5
Diglyceride	15.2
Triglyceride	0.1

Table 5: Composition of monoglyceride based on moringa oil

- 5 The distilled monoglyceride was protected with antioxidant:
Grindox 349: 1.87g

EXAMPLE 2 - Preparation and testing of peanut butters

10 EXPERIMENTAL

Procedure

The following equipment was used:

- 15 Scale; Steam bath; Chilled water bath; 5 Quart stand mixer; Water jacketed mixing bowl with connections to water bath; Mixing paddle; Tubing; Metal container ; 250 ml beaker ; Rubber spatula; and Infrared thermometer.

Set-up:

20

Connect tubing from chilled water bath to mixing bowl as follows. Place the inflow of the water bath to the top connector on the mixing bowl and outflow of the water bath to the bottom connector on the mixing bowl. Set temperature of the water bath to 120°C. Allow water bath to come to temperature before adding mixture to bowl.

25

Processing:

Place peanut butter paste in metal container and place on a steam bath bringing the temperature of the peanut butter paste to 82°C. Add stabilizer, salt and sugar to peanut butter paste.

- 5 A range of stabilisers were tested both at dosages of 1.5wt% and 3%. Stabilisers were used individually and in combination.

Samples containing 1.5% stabiliser had the following composition

Ingredients		Batch Size
Peanut Butter Paste	90.50%	905 g
Stabilizer	1.50%	15 g
Sugar	6.50%	65 g
Salt	1.50%	15 g
		1000 g

- 10 Samples containing 3.0% stabiliser had the following composition

Ingredients		Batch Size
Peanut Butter Paste	89.00%	890 g
Stabilizer	3.00%	30 g
Sugar	6.50%	65 g
Salt	1.50%	15 g
		1000 g

Continue to mix at 82°C until formula has been thoroughly mixed, 5 to 10 minutes. Pour into mixing bowl and mix on low. Cool mixture to 33-35°C, pour into 2 jars and attach lids. Store sample at 20°C. Evaluate samples at 48 hours and 2 weeks.

15

Sample Evaluation:

At 48 hours and 3 weeks, the product is evaluated. Evaluation may include the following characteristics:

20

Cone penetrometer- Readings should be taken from both the middle and the side. Drop probe and measure distance versus time.

Appearance in jar - Note abnormalities such as product pulling away from jar, cracking

Appearance of surface - Note product shine or dullness

Spread on cardboard - Note the consistency of product

Mouth feel - Note the texture of product in mouth

Taste - Note flavor release and overall taste

5

Samples were measured for firmness by way of a penetrometer with cone probe and 50 g weight. Drop lever was pressed for 5 seconds and the distance (mm) traveled by probe was measured. Maximum distance was 30.5 mm.

- 10 Appearance of peanut butter in jar was observed, noting shininess or dullness, oiling off, cracking and pull away. Consistency and texture were also observed by spreading peanut butter on cardboard, noting ease of spread and oiling off.

DSC:

15

Differential scanning calorimetry (DSC) was performed in duplicate. The concentration of stabilizer in vegetable oil (peanut oil) was 3% for control PS105, and thereafter stabilizer addition was 6% total. Approximately 2-5 mg of sample was weighed into a pan.

- i) heat samples from 0° to 80°C at a rate of 5°C / min
20 ii) cool down from 80° to 0°C at a rate of 5°C / min
iii) heat the sample again from 0° to 80°C at a rate of 5°C / min

Rheology:

- 25 All rheological experiments were carried out on a Haake RS 150 controlled stress rheometer, where small angle oscillatory measurements were carried out. The samples (based on peanut oil and the control PS 105 at 3%, then all subsequent samples are at total of 6% dose) were first placed in a microwave and heated for a total of two minutes at 800W to take the temperature above 90°C, and thereby eliminate all previous crystal
30 history. The hot fluid sample was now added to the rheometer and the plates closed to gap, and the measurement begun. The running conditions were as follows; a temperature ramp from 85 to 25°C was run at a cooling rate of 1°C per minute, the strain was held constant at 0.004 +/- 0.001. The gap used was 0.5mm, and the frequency of oscillation as 0.5Hz - all well within the linear viscoelastic region. The plates used were
35 both 35mm parallel serrated plates, and 120 data points were recorded in a linear data collection mode during the measurement.

RESULTS

Stabilizer	Use Level	Penetrometer (mm)	Notes
PS 105	1,50%	22,10	Standard peanut butter
PGPR 90	1,50%	30,50	Setimentation of solids
Moringa 132	1,50%	30,50	Liquid
Moringa 105	1,50%	30,50	Liquid
PS 105 + Moringa 132 (50/50)	1,50%	30,50	Soft set, shiny
PS 105 + PGPR 90 (50/50)	1,50%	30,50	Soft set, air bubbles trapped on top
PS 105	3,00%	14,00	Appeared like standard peanut butter but very firm
PGPR 90	3,00%	30,50	Setimentation of solids
Moringa 132	3,00%	30,50	Set
Moringa 105	3,00%	30,50	Soft set
PS 105 + Moringa 132 (50/50)	3,00%	25,80	Similar to PS 105 at 1.5%
PS 105 + PGPR 90 (50/50)	3,00%	29,00	Soft set, air bubbles trapped on top

- 5 GRINDSTED® PS 105 is a triglyceride prepared from Kosher approved blend of edible, refined, fully hydrogenated rapeseed, cottonseed and soybean oils, available from Danisco A/S, Denmark

- GRINDSTED® PGPR 90 is a polyglycerol polyricinoleic acid available from Danisco A/S,
10 Denmark. It is polyglycerol ester of polycondensed fatty acids from castor oil.

- The results of the rheology determination show that Moringa and PGPR are able to enhance crystallisation kinetics of the second stabilizer (PS 105), but also Moringa is able to induce onset of viscosity (in other words – crystallisation) and are shown in
15 Figures 1 and 2.

The results of the DSC is shown in Figures 3 to 7.

EXAMPLE 3 - Preparation and testing of Liquid Bread Improvers

MATERIALS & METHODS

- The recipes of the liquid bread improvers tested are given in Table 11, where sample 51 is a reference with GRINDSTED® PS 209, samples 52 and 53 have MM dosed in at 2.5 and 5% respectively and sample 54 contains a mixture with GRINDSTED® PS 209 at 1% and MM at 3% levels. GRINDSTED® PS 209 is a blend of mono- and triglycerides based on edible, fully hydrogenated rapeseed oil.

Ingredients in %				
Ingredient Name	51	52	53	54
Water phase				
Ascorbic acid	3,000	3,000	3,000	3,000
Grindamyl H 121	4,500	4,500	4,500	4,500
Water phase total	7,500	7,500	7,500	7,500
Fat phase				
Fat blend				
Rapeseed oil	100,000	100,000	100,000	100,000
Fat blend total	100,000	100,000	100,000	100,000
Other fat ingredients				
GRINDSTED® PS 209 Fat/Emulsifier Blend	2,500			1,000
Distilled Monoglyceride, Moringa Oil (Lot 2461-208)		2,500	5,000	3,000
Other fat ingredients total	2,500	2,500	5,000	4,000
Fat phase total	92,500	92,500	92,500	92,500
RECIPE total (calc. batchsize)	100,000	100,000	100,000	100,000

Table 11 Recipe for the liquid bread improvers tested.

- 10 The procedure for running these recipes is given as follow:

Fat phase:

1. Weigh out emulsifiers and oil/fat in the same container
2. Heat to 80°C
- 15 3. Stir fat phase until mixed well
4. Cool fat phase to 60°C

Samples:

1. Fill into 4 x 50g containers, rest for 2 hours and measure
- 20 2. Fill into steel containers and leave to rest for 2 hours, stir for 10 minutes, fill into 4 x 50g containers and measure

3. Stir for 5 minutes while adding dry ingredients, fill into 4 x 50g containers and measure

The running conditions on the pilot plant are given by Table 12.

Pilot Plant				
Processing (3-tube lab perfector):	51	52	53	54
Oil phase temperature	55	55	55	55
Water phase temperature				
Emulsion temperature	55	55	55	55
Centrifugal pump	Auto	Auto	Auto	Auto
Capacity high pressure pump	50	50	50	50
Cooling (NH3) tube 1:	-10	-10	-10	-10
Cooling (NH3) tube 2:	-10	-10	-10	-10
Rpm tube 1:	950	950	950	950
Rpm tube 2:	950	950	950	950

5 Table 12 Plant running conditions for the liquid bread improver samples tested.

The samples were measured under three separate conditions to obtain their viscosity versus shear stress profiles using a controlled stress rheometer (Haake RS 150). The first measurement took place on unstirred samples, which had been allowed to stand for two hours. The second set of measurements took place on stirred samples after standing for two hours and the third set was done on the stirred sample to which powders had been added. The first two sets of measurements were performed with a cup-bob geometry of 20mm diameter and run over a stress ramp from 0.1 to 100Pa over a time range of 240 seconds. 200 data points were gathered in a logarithmic distribution at 23°C. The samples with the powder had the same running conditions, but the measurement geometry was changed to a serrated set of parallel plates due to the powder inclusion.

RESULTS & DISUCSSION

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The results given in Figure 8 show the viscosity versus shear stress profiles for the four samples tested after the samples have been allowed to stand at rest after production. The samples have not been stirred. In each case we see the characteristic pseudoplastic behaviour, a low stress Newtonian like plateau followed by a reduction in viscosity after a certain critical stress has been reached. The sample with GRINDSTED® PS 209 alone, shows the greatest viscosity and demonstrates a profile that has been seen before both in terms of profile shape and viscosity value. The two samples with MM at 2.5% and 5%

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concentration follow the expected concentration gradient, but are considerably less viscous than the sample with GRINDSTED® PS 209 by up to and beyond an order of magnitude. The relative size of the low stress Newtonian plateau similarly is influenced by concentration, stretching longer in the MM sample of highest concentration. The last
5 sample where GRINDSTED® PS 209 at 1% is combined with MM at 3% is very similar in profile shape to that of GRINDSED® PS 209 alone, but is slightly lower in viscosity.

After the samples have been allowed to rest for two hours they are then subject to a stirring process to break the primary bonds of the fat structure and to initiate the
10 secondary bonds. The viscosity – shear stress profiles for this are given in Figure 9.

After stirring all samples have reduced in viscosity and the similarity in profile shape is still evident between GRINDSTED® PS 209 alone and in combination with MM

15 The data given in Figure 10 shows the viscosity versus shear rate profiles for the samples after stirring and with powders added. Visually, the samples appeared white and opaque, but the samples with MM alone, especially at 2.5% dosage were very low in viscosity. As is given in Figure 10 the visual evaluation was also able to pick out the most and least viscous correctly. The viscosity profiles for MM samples at 2.5% or 5% show a
20 low degree of stability against increasing stress.

This leads to the suggestion that MM may be able to be used in combination with other ingredients to give specific functionality.

25 CONCLUSION

Monoglycerides of Moringa (MM) were incorporated into liquid bread improver systems at 2.5% and 5.0% in isolation and in combination with GRINDSTED® PS 209 at 1.0% and MM at 3.0%. This was compared against the reference sample of GRINDSTED®
30 PS 209 at 2.5%. The systems were measured after two hours rest (no stirring); after two hours and stirring, and after addition of powders. In each case the lowest viscosity could be attributed to the MM samples in order of concentration. Combined with GRINDSTED® PS 209, the MM gave a profile that was similar to the reference in the non-stirred sample, but lower viscosity thereafter. The power containing samples with
35 MM were low in viscosity. The GRINDSTED® PS 209 / MM sample with powders was higher in viscosity. The results demonstrate that all liquid bread improver samples show

reducing viscosity with increasing stress. The samples with MM have the lowest viscosity throughout. The sample of MM and GRINDSTED® PS 209 combined shows similar profiles to that of GRINDSTED® PS 209 alone, albeit at lower viscosity values.

REFERENCES

Mullin, J.W. (1993) "Crystallisation" 3rd Ed. Butterworth – Heinemann, UK. Pp 292-293.

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Various modifications and variations of the present invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in chemistry, biology or related fields are intended to be within the scope of the following claims.

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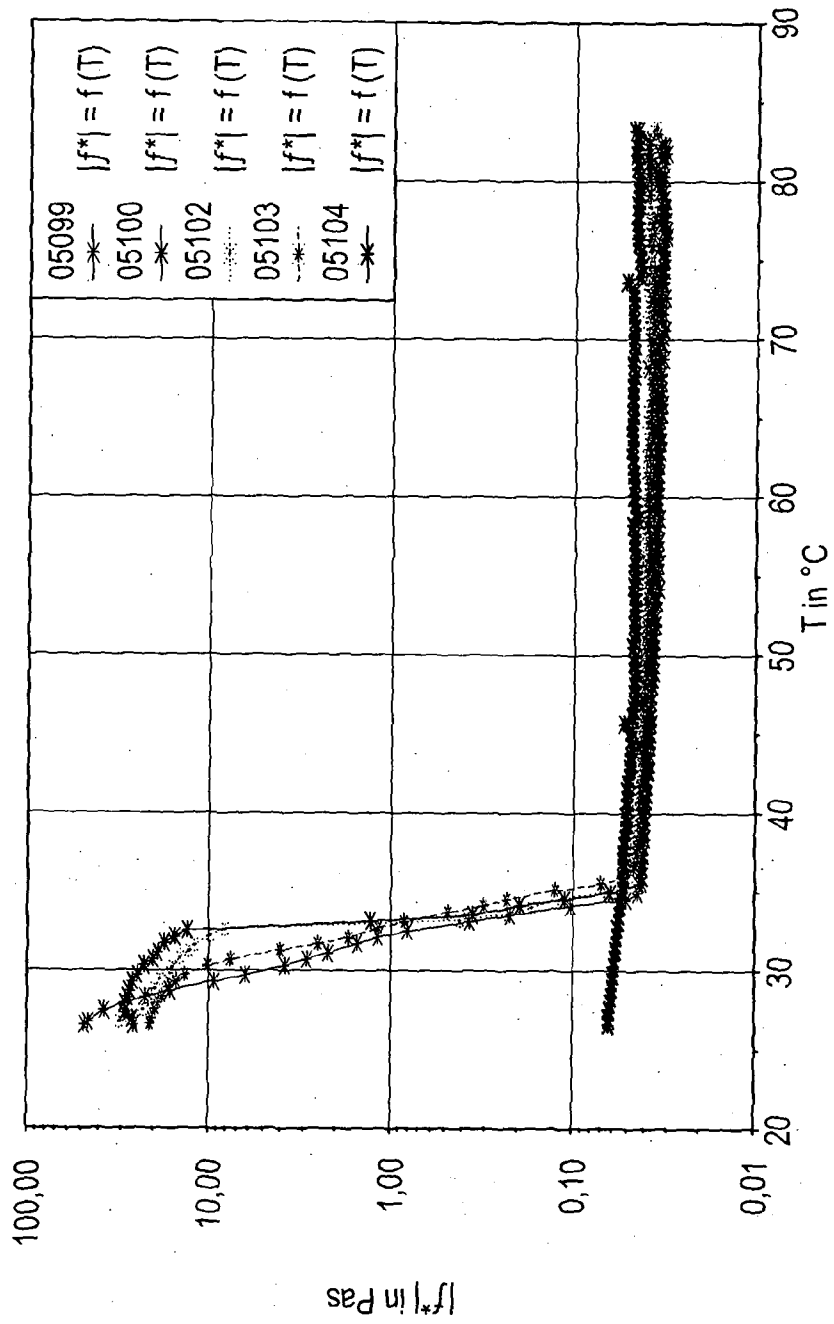
CLAIMS

1. A dispersion comprising
 - (i) a triglyceride continuous phase;
 - 5 (ii) a triglyceride dispersed phase; and
 - (iii) a mono or di ester of glycerol and Moringa oil.
2. A dispersion according to claim 1 wherein the triglyceride continuous phase is a liquid triglyceride.
- 10 3. A dispersion according to claim 1 or 2 wherein the triglyceride continuous phase is selected from palm oil, rape seed oil, sunflower oil, fish oils, soybean oils, coconut oils, ricebran oils, dag oils, beef tallow, allanblackia oils and shea fat.
- 15 4. A dispersion according to any one of claim 1, 2 and 3 wherein the triglyceride dispersed phase is solid triglyceride.
5. A dispersion according to any one of the preceding claims wherein the triglyceride dispersed phase is selected from palm oil, rape seed oil, sunflower oil, fish oils, soybean
20 oils, coconut oils, ricebran oils, dag oils, beef tallow, allanblackia oils and shea fat.
6. A dispersion according to any one of the preceding claims wherein the dispersion contains water in an amount of less than 1 wt.% based on the total dispersion.
- 25 7. A dispersion according to any one of the preceding claims wherein the dispersion is a food additive or food ingredient.
8. A dispersion according to claim 7 wherein the food additive or food ingredient is selected from nut butters, seed butters, shortenings and liquid bread improvers.
- 30 9. A dispersion according to claim 7 wherein the food additive or food ingredient is a liquid bread improver.
10. A dispersion according to claim 7 wherein the food additive or food ingredient is
35 selected from nut butters and seed butters.

11. A dispersion according to claim 10 wherein the nut butter or seed butter is selected from almond butter, cashew butter, hazelnut butter, macadamia nut butter, peanut butter, pecan butter, pistachio butter, walnut butter, pumpkin seed butter, sesame seed butter (tahini), soybean butter and sunflower seed butter.
- 5 12. A dispersion according to any one of the preceding claims wherein the dispersion is a food suitable for human consumption.
- 10 13. A dispersion according to claim 12 wherein the food is selected from candy bars, whipable fillings, protein drinks, beverage whiteners, milk shake concentrates and savoury flavourings.
14. A dispersion according to any one of claims 1 to 7 wherein the dispersion is a feed suitable for animal consumption.
- 15 15. A dispersion according to claim 14 wherein the feed is selected from poultry feed, aqua culture feed, bovine feed and porcine feed.
16. A process for preparing a dispersion according to any one of claims 1 to 15, comprising the steps of
- 20 (a) contacting
- (i) a first triglyceride; and
- (ii) a second triglyceride;
- wherein the first triglyceride and second triglyceride are different
- 25 (b) forming a dispersion wherein the first triglyceride provides a continuous phase and wherein the second triglyceride provides a dispersed phase; and
- (c) contacting the first triglyceride and the second triglyceride either before step (b) or after step (b) with a mono or di ester of glycerol and Moringa oil.
- 30 17. Use of a mono or di ester of glycerol and Moringa oil to prepare or stabilise a dispersion comprising
- (i) a triglyceride continuous phase; and
- (ii) a triglyceride dispersed phase.
- 35 18. A dispersion as substantially described herein with reference to the examples.

19. A process as substantially described herein with reference to the examples.

20. A use as substantially described herein with reference to the examples.



05099 = 3% PS 105
05100 = 3% PS 105 + 3% Moringa 132
05102 = 3% PS 105 + 3% PGPR 90
05103 = 6% Moringa 132
05104 = 6% PGPR 90

FIG. 1

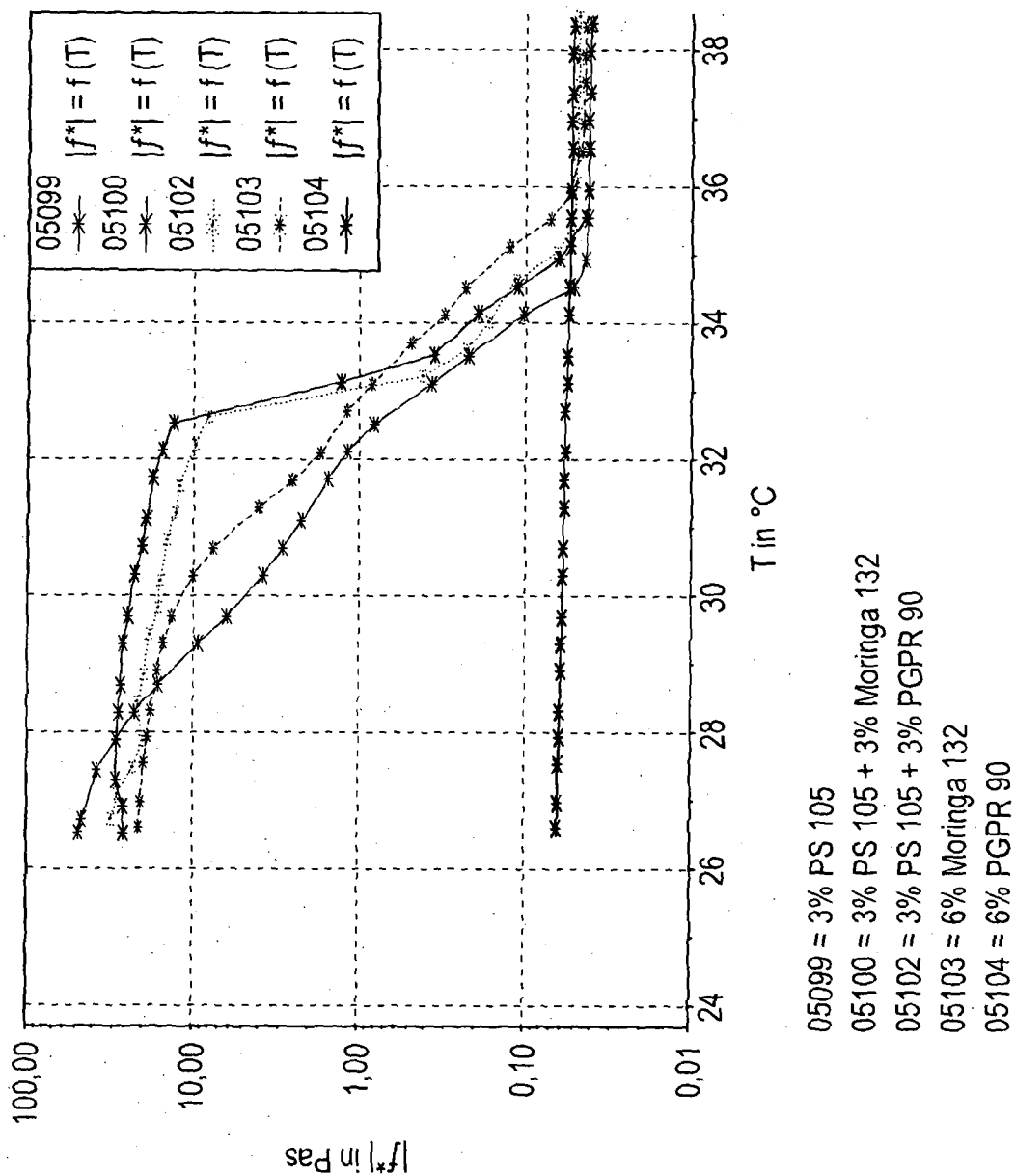
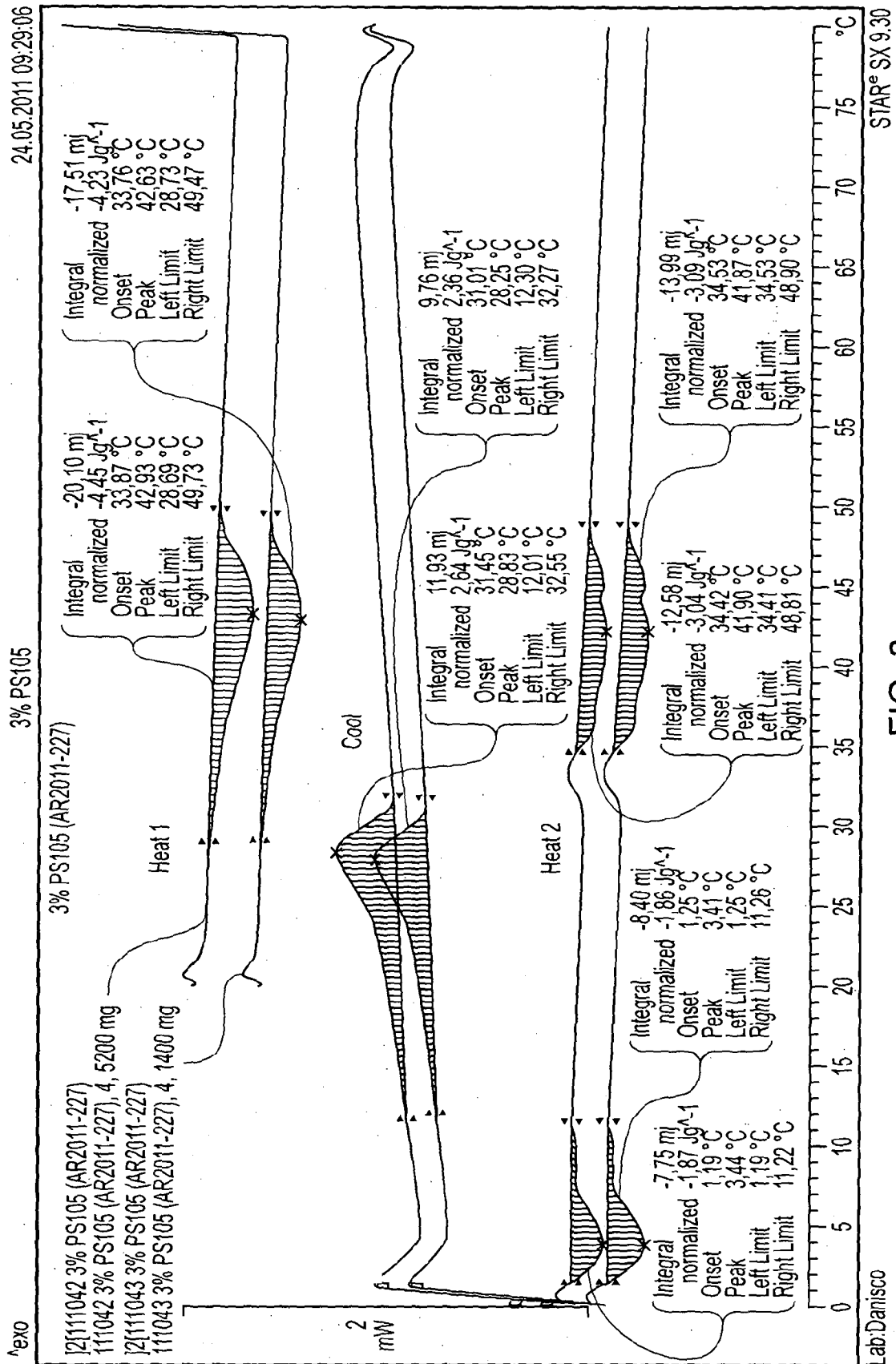
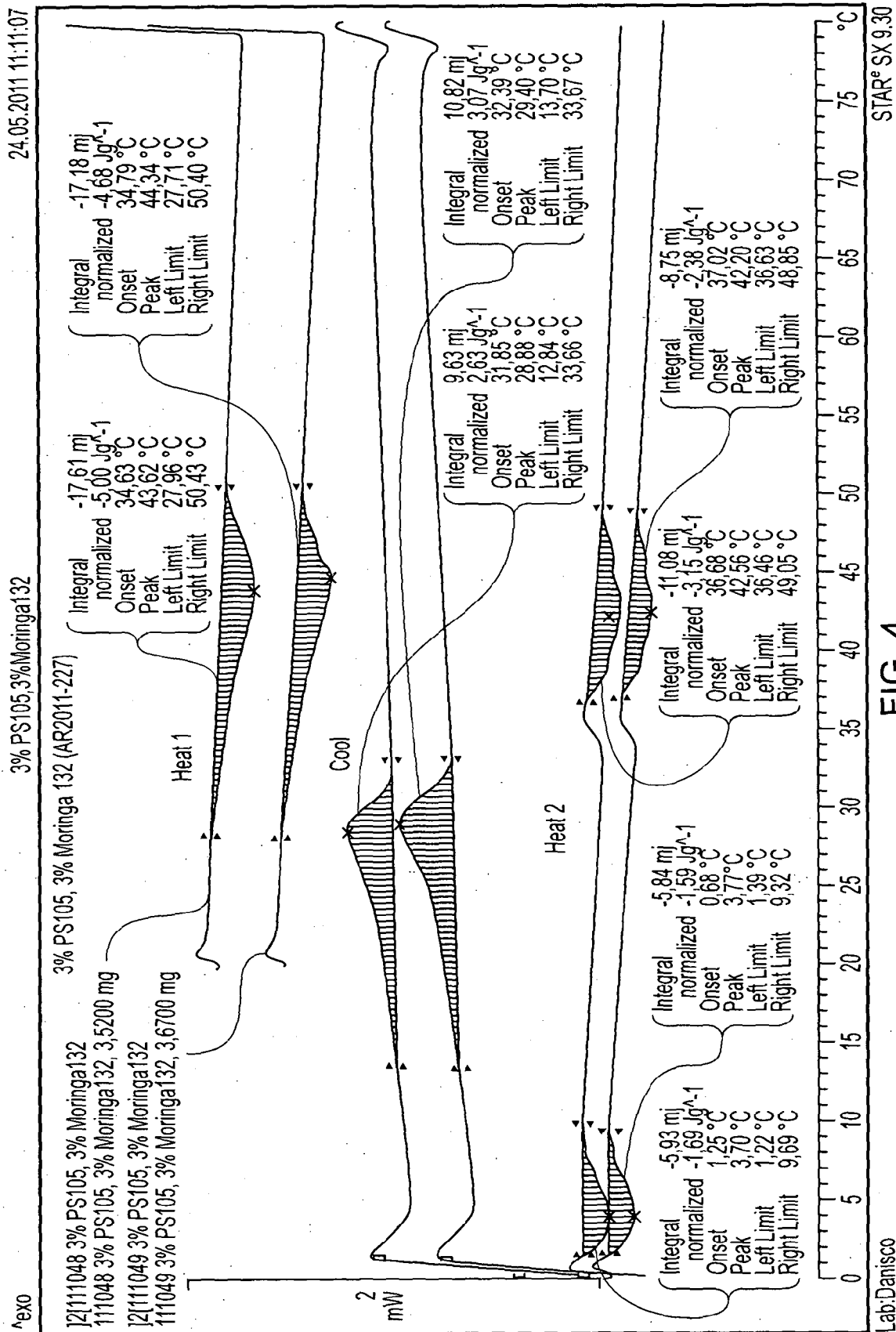


FIG. 2

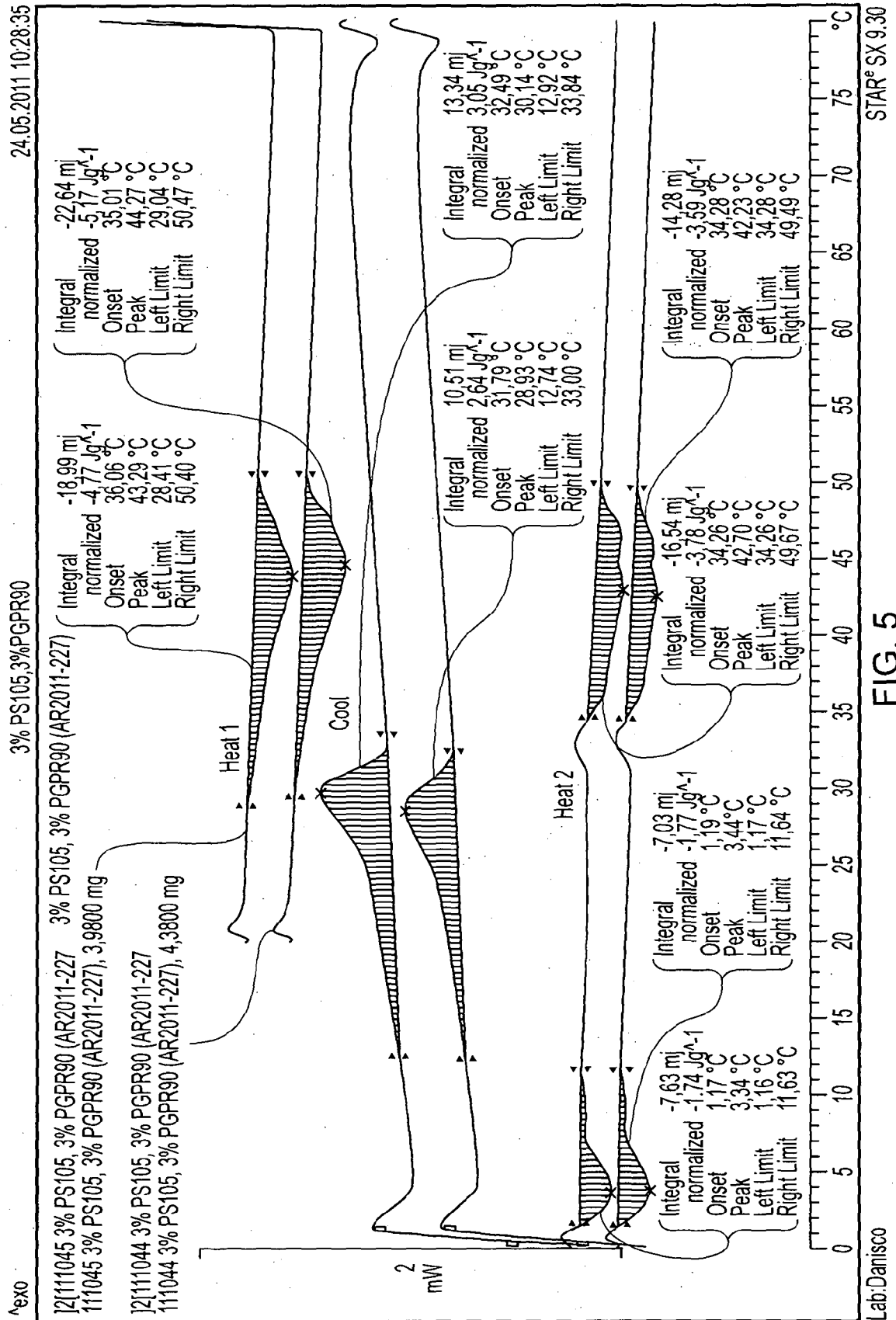
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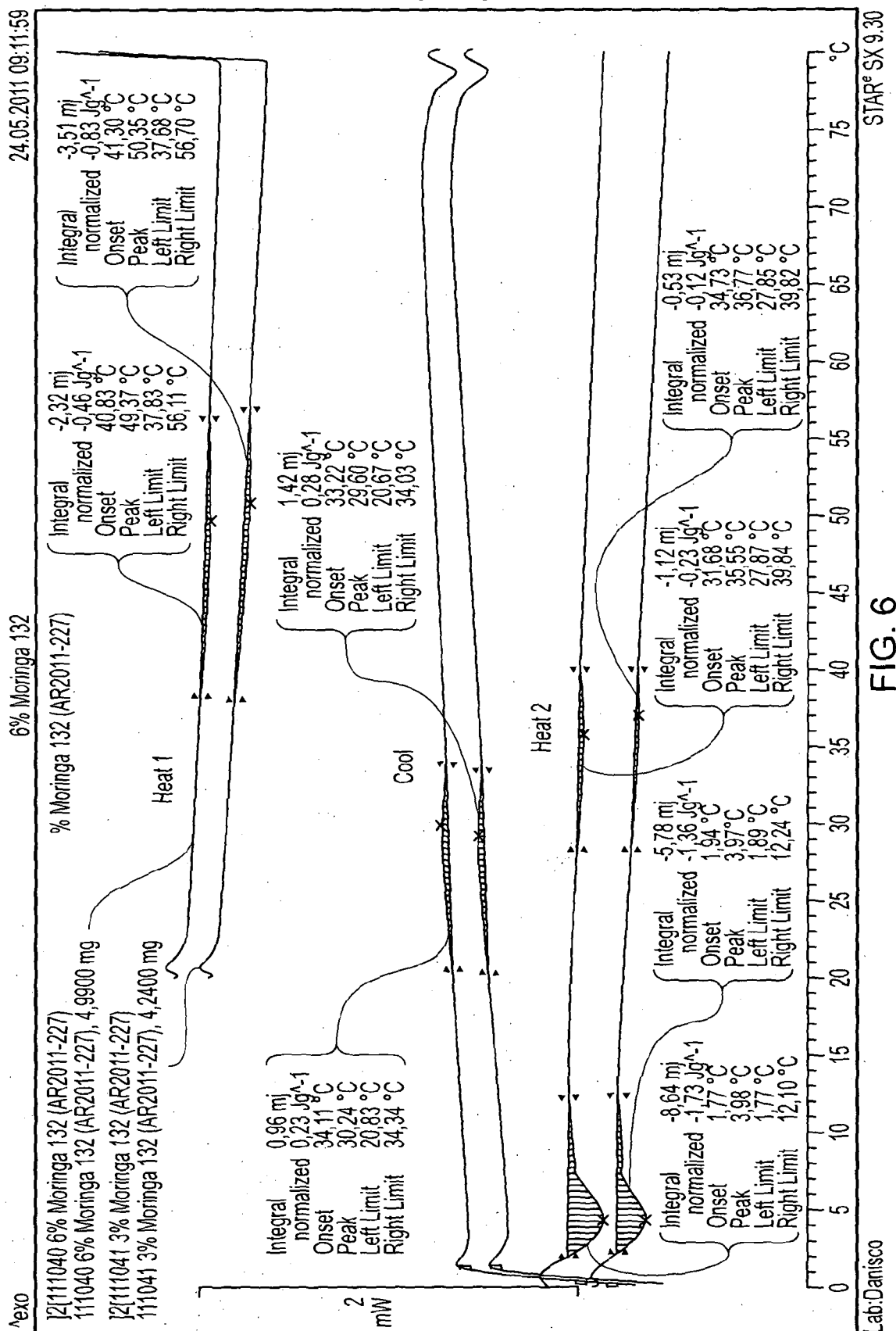


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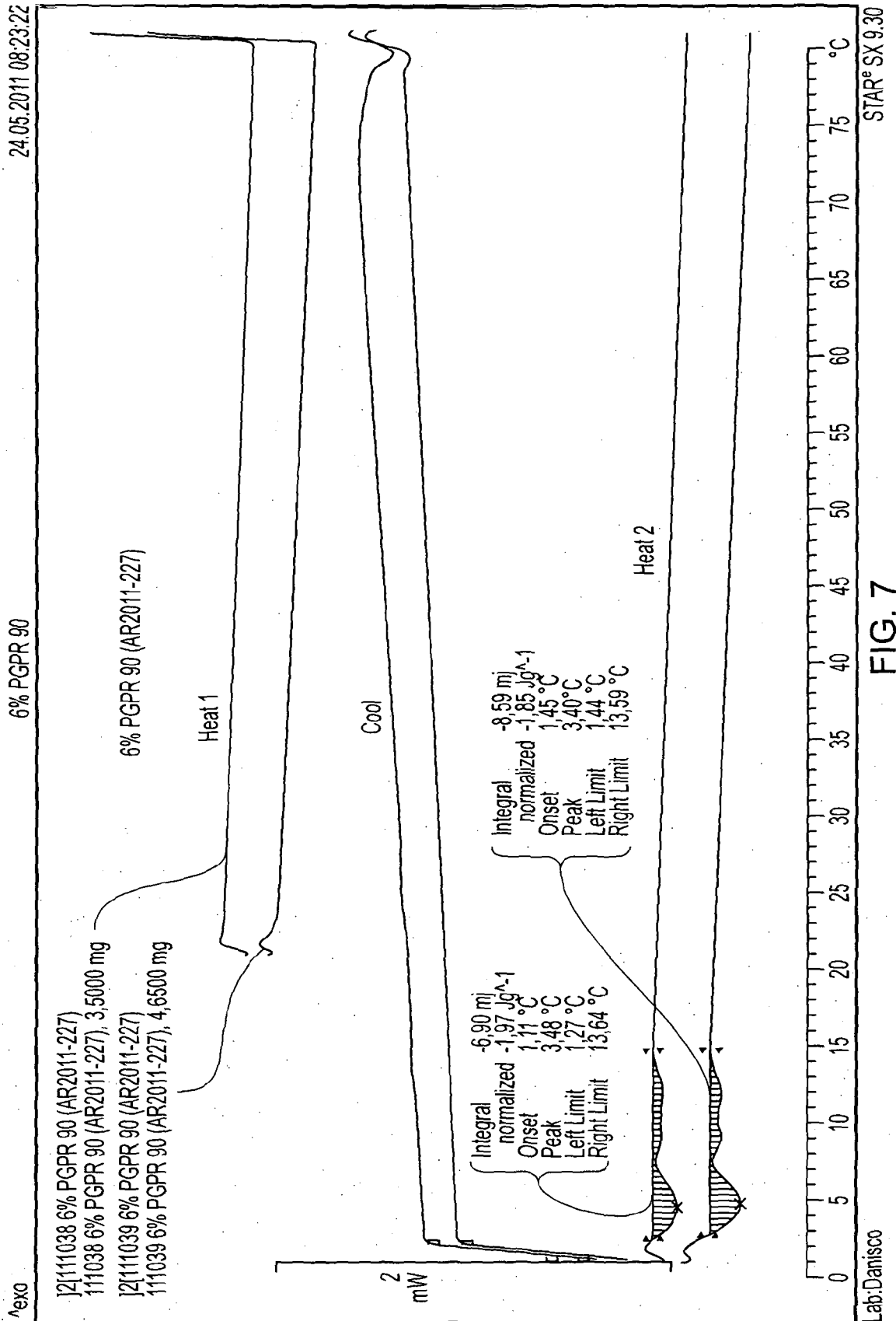


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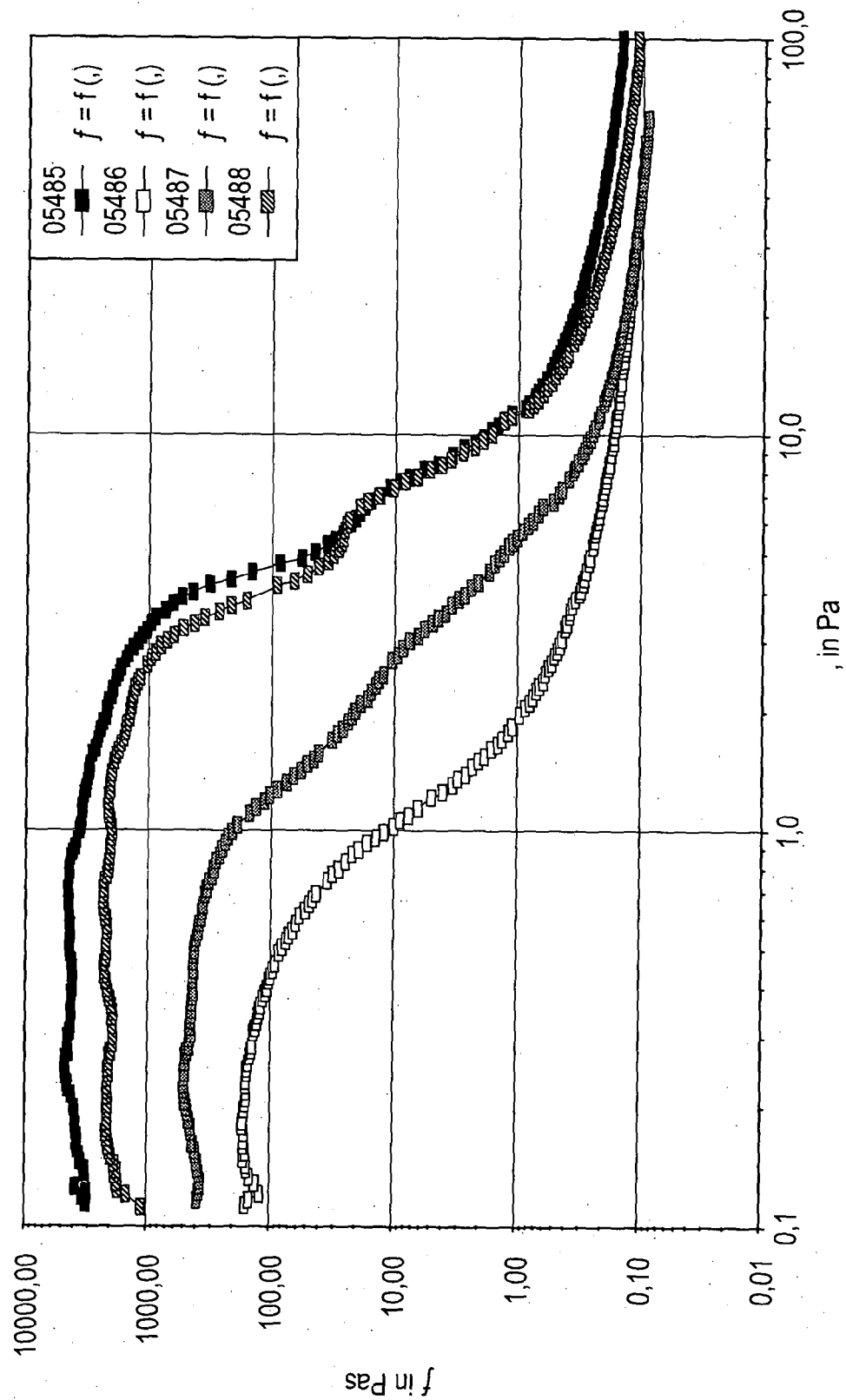


FIG. 8

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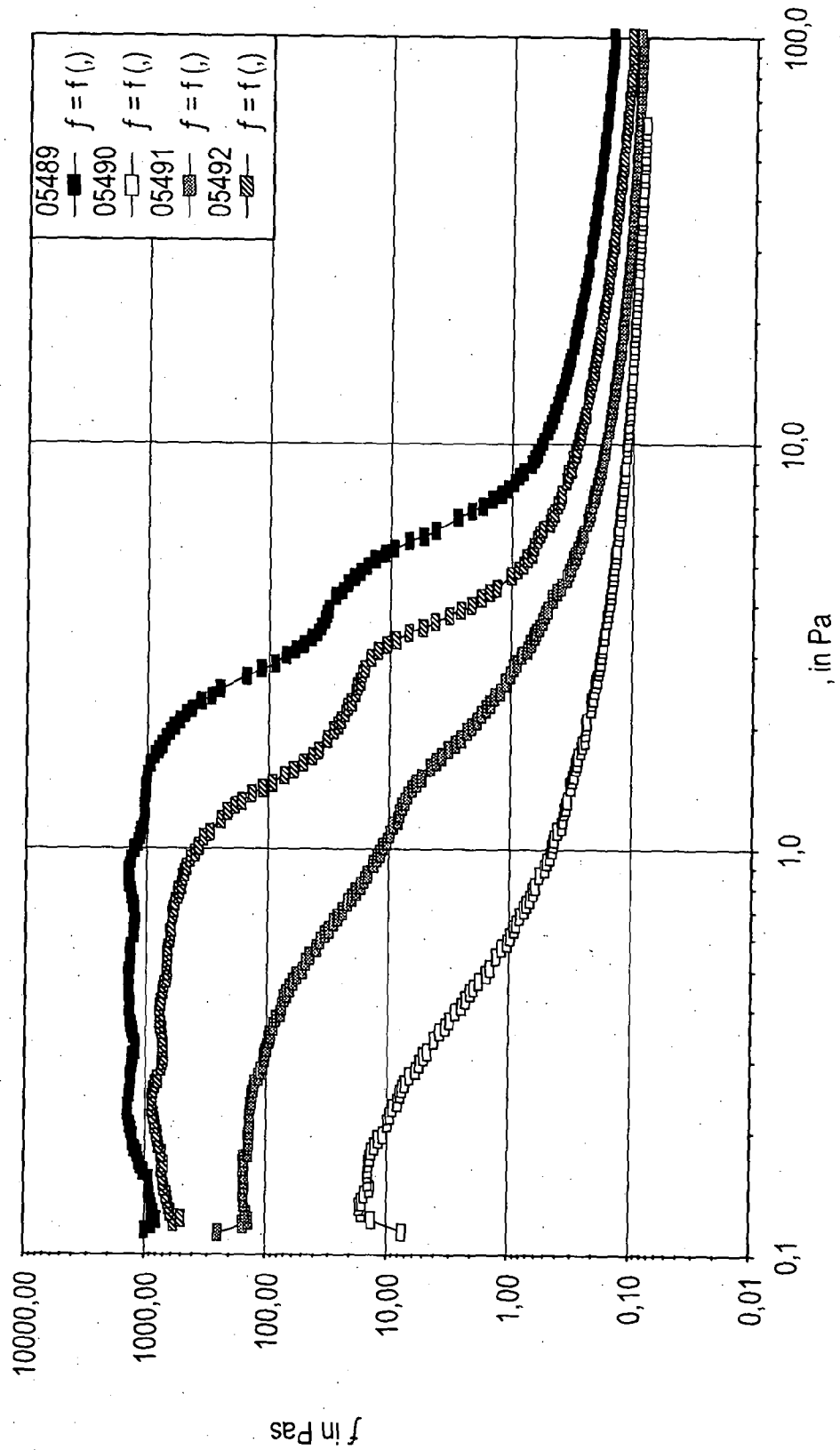


FIG. 9

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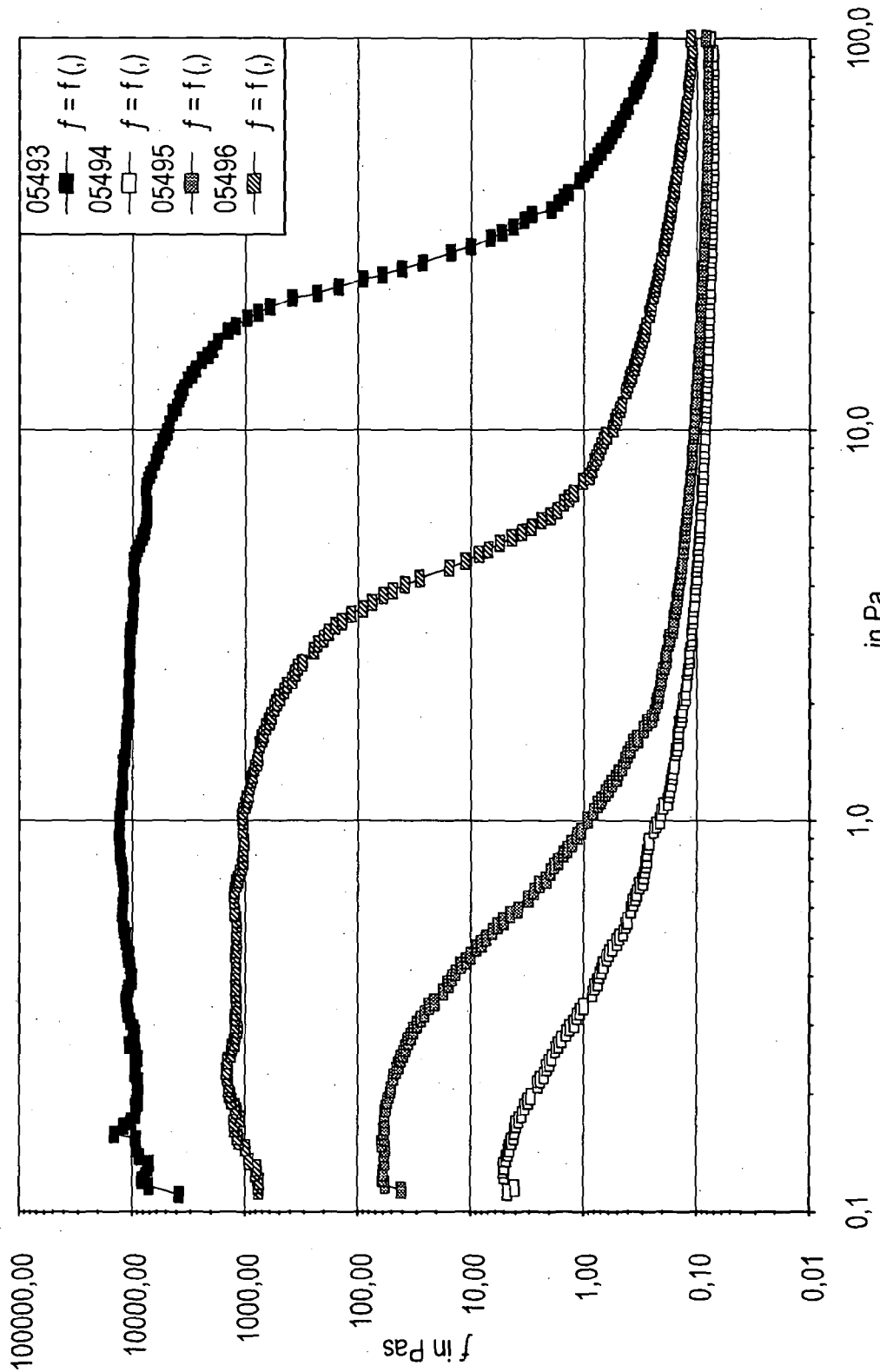


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2012/051292

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23D9/007 A23D9/013
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A23D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PERNETTI ET AL: "Structuring of edible oils by alternatives to crystalline fat", CURRENT OPINION IN COLLOID AND INTERFACE SCIENCE, LONDON, GB, vol. 12, no. 4-5, 2007, pages 221-231, XP022266054, ISSN: 1359-0294, DOI: 10.1016/J.COCIS.2007.07.002 Introduction; 2.1 Suspensions and emulsions; 3. Recent development in structuring edible oils; 5. Conclusions and outlook ----- -/--	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

8 August 2012

Date of mailing of the international search report

28/08/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Moonen, Peter

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2012/051292

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	----- SINGH S P ET AL: "Biodiesel production through the use of different sources and characterization of oils and their esters as the substitute of diesel: A review", RENEWABLE AND SUSTAINABLE ENERGY REVIEWS, ELSEVIERS SCIENCE, NEW YORK, NY, US, vol. 14, no. 1, 1 January 2010 (2010-01-01), pages 200-216, XP026670593, ISSN: 1364-0321, DOI: 10.1016/J.RSER.2009.07.017 [retrieved on 2009-08-03] the whole document	1-20
A	----- EP 1 166 639 A1 (FUJI OIL CO LTD [JP]) 2 January 2002 (2002-01-02) abstract; claim 16	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2012/051292

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EP 1166639	A1	02-01-2002	CN 1353578 A 12-06-2002
			DE 60017552 D1 24-02-2005
			DE 60017552 T2 25-08-2005
			EP 1166639 A1 02-01-2002
			JP 3661593 B2 15-06-2005
			US 6737100 B1 18-05-2004
			WO 0057715 A1 05-10-2000
