WO2017172594 describes an oleogel comprising an ethylcellulose polymer, a food oil and a dispersant. Similarly, the international application WO2014193667 describes an oleogel that is generated by extrusion of ethylcellulose with at least one oily feed material. Furthermore, US patent application US2019/0075811 describes a method of making an ethylcellulose oleogel by slow cooling of a mixture of ethylcellulose polymer and oil from 100° C. to 35° C.

A well-known ingredient that would be a suitable oil gelator with high potential for inclusion in food products is protein. Proteins have good nutritional value, have no regulatory issues for their use and would contribute to 'clean labelling'. Given their hydrophilic nature and insolubility in oil, proteins are not the most obvious choice for the preparation of oleogels. At normal conditions, protein will not disperse well in oil, and no gel forming ability of proteins in oil is obtained. Apparently, there is not enough attractive interaction between the proteins and therefore they sediment over time.

Nevertheless, attempts have been made to generate oleogels comprising protein as gelator for oil. For example, the Chinese patent application CN109122920A describes an oil in water emulsion comprising protein, grease, water and edible glue. The European patent application EP1836897 describes a solid product comprising oil-droplets having a diameter in the range of 0.1 to 100 microns, comprising cross-linked proteins at the interface of said droplets. Said proteins are cross-linked, for example, by addition of glutaraldehyde and/or transglutaminase. The European patent application EP3011836 describes stable dispersants of protein in oil using a solvent exchange procedure in which water is exchanged in consecutive steps for an oil.

There is thus a need for a simple, convenient procedure for the production of an oleogel that comprises mainly protein and oil, without a need to provide further ingredients such as a glue or a chemical cross-linker.

BRIEF DESCRIPTION

The current disclosure describes the production of an oleogel that is based on proteins without the use of non-edible solvents or the presence of surfactants.

Proteins are ideal, as they are not considered an “additional” ingredient on a food label and do not need an E-number. In addition, they are considered as healthy.

Water was shown to increase the interactions between proteins and to induce strong network formation. This is most likely due to strong capillary interactions, with a maximum network formation at 0.5 g water/ g protein (de Vries et al., 2018. Food Hydrocolloids 79:100-109). As is known to a person skilled in the art, this optimal water content will vary between about 0.05 and 2 g water/ g protein, for different types of protein. An additional heating step was shown to increase the gel strength even further (de Vries et al., 2018. Food Hydrocolloids 79:100-109).

In one aspect, the disclosure provides a method for the production of an oleogel, the method comprising (i) providing a 0.5-40 wt. % dispersion of protein in oil; (ii) adding between 0.05 and 1 gram of water per gram protein to the dispersion; and (iii) mixing the ingredients for a sufficient period of time to produce a solid oleogel.

If required, the protein in oil dispersion may be homogenized, preferably by sonication, prior to the addition of water.

If required, between 0.1 and 5 gram of a dispersing agent, preferably ethanol, is added to the protein in oil dispersion, prior to the addition of water.

In a preferred method, the total amount of water is added in two or more steps to the dispersion, preferably the total amount of water is added in steps of 0.05-0.25 water/gram protein. Each of these steps preferably is allowed to mix for a period of 10 minutes-48 hours, preferably for a period of 1-24 hours.

After the addition of water, the produced solid oleogel may be heated to a temperature between 25 degrees Celsius and the boiling point of the oil.

A preferred method of the disclosure results in the production of an edible solid oleogel.

The protein that is used in the methods for producing an oleogel according to the disclosure preferably is a globular protein.

The oil that is used in the methods for producing an oleogel according to the disclosure preferably is a vegetable oil.

Oleogels according to the disclosure can thus be used as an alternative for solid fats, such as palm oil, cocoa butter, animal fat and milk fat. With the present method an oleogel can be obtained that can be used for inclusion in food products, cosmetics or other personal care products, but also e.g. for drug delivery (e.g. a pharmaceutical product). The oleogel thus provided can be Generally Recognized As Safe (GRAS) material.

In another aspect, the disclosure provides an oleogel, preferably an edible oleogel, comprising 0.5-40 wt.% protein, preferably 8-40 wt.% protein, 0.1-40 wt. % of water, and 20-99.5 wt. % oil. Said oleogel preferably is produced by a method of the disclosure.

In yet another aspect, the disclosure provides a product, preferably a food product, comprising an oleogel as defined above. Said food product may be selected from baked goods, chocolate and fillings, or is a meat product. A non-food product may be suited for cosmetic and/or pharmaceutical applications.

FIGURE LEGENDS

Figure 1. Gel-like material obtained by the methods of the invention. Gel mass obtained after adding 0.25 g water/ g proteins (A); 0.5 g water/ g proteins (B); or 0.75 g water/ g proteins (C). All samples were heated at 85 °C for 20 minutes after the addition of water.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

The terms “oleogel” and ”protein oleogel”, as are used herein, refer to a gel having an oil as a continuous phase, while the percolation structure is based on protein. Said oleogel preferably does not comprise a gelling agent, surfactant, cross-linking agent and/or glue. The oleogel preferably consists of protein and oil, in the presence of a small amount of water.

The term “oil”, as is used herein, refers to a lipid-based material comprising glycerides such as triglycerides that is fluid at ambient or room temperature, i.e. at 25 degrees Celsius.