different type of fuel. Overall, alcohols, or methanol, have no lubricity and no self-ignition capability, which makes their use in a self-igniting engine unsuitable.

The object of the present disclosure is to provide a diesel-containing fuel for self-igniting internal combustion engines, in which further low-ignition components are contained.

A method according to the disclosure for producing such an emulsion for use in an internal combustion engine, an internal combustion engine and/or a power generation system comprises the following steps:

A Providing a solvent mixture comprising at least an alcohol and an oil. Preferably, the alcohol content of the solvent mixture is more than 30% by weight, preferably more than 55% by weight, preferably more than 90% by weight.

Said solvent mixture may also contain another polar solvent, such as a short-chain alcohol.

B Treating the mixture from step A with at least one cavitator to form an emulsion, wherein the cavitator is part of a circuit;

C Optional guidance of the emulsion in the circuit and at least one repetition of step B to form a multiple emulsion;

In one aspect, the disclosure provides a method for producing an oil- or diesel-in-alcohol emulsion for use in a self-igniting internal combustion engine, an internal combustion engine and/or a system for generating energy, characterized by the following steps of:

A providing a solvent mixture comprising an oil and/or a diesel fuel and a polar solvent in the form of an alcohol;

B treating the mixture from step A with at least one cavitator to form an emulsion, and

D transferring the emulsion to the self-igniting internal combustion engine, wherein the method further comprises the following step between steps B and D:

C repeating step B at least once to form a multiple emulsion, preferably by guiding the emulsion in a circuit,
wherein treatment in C takes place in a working range from more than 6 bar up to a maximum of 75 bar.

The treatment after step B and the recirculation after step C makes it possible to form a multiple emulsion, in particular a so-called double emulsion, having several layers of finely distributed oil droplets of particularly small size, which is stable over a period of about 2 minutes. This is a comparatively long time for the type of suspension mentioned above. In most cases, separation occurs after just a few seconds.

The treatment in step B or C takes place in a working range from more than 6 bar to a maximum of 75 bar, in particular from more than 10 bar to a maximum of 75 bar, preferably from 60 bar to a maximum of 75 bar or from 12 bar to a maximum of 20 bar.

D Transferring the emulsion, especially the multiple emulsion, into the self-igniting internal combustion engine.

This multiple emulsion can then be transferred to an internal combustion engine. It is surprising that the combustion engine ignites with this type of emulsion and runs stably with high efficiency.

Advantageous variants of the method are the subject matter as described herewith.

The circuit can advantageously have a conductivity sensor, preferably between a container in which the supply of further solvent mixture in the circuit takes place and the cavitator, for determining the conductivity of the solvent mixture, wherein the supply of further solvent mixture into the circuit takes place as a function of the determined conductivity.

The non-polar component of the solvent mixture in the process can preferably be an oil, in particular a vegetable oil, such as rapeseed oil or a diesel fuel, hereinafter also referred to as diesel oil.

The alcohol used is preferably a monohydric short-chain alcohol with a number of carbon atoms in the molecule of less than or equal to 4.

To form a particularly well-mixed and consequently more stable emulsion, it is advantageous if a temperature difference of at least 10 K, preferably at least 15 K, particularly preferably between 15-35 K, is provided between the alcohol-containing phase or emulsion with an alcohol content of more than 30% by weight from step A) and the oil or diesel fuel from step B).

The oil or diesel fuel preferably has a lower temperature than the alcohol or the non-polar solvent. This can be cooled in particular.

The oil-in-alcohol and/or the diesel-in-alcohol emulsion in step C can contain at least 1% by weight of oil or diesel droplets, preferably at least 2% by weight of oil or diesel droplets, particularly preferably at least 3-8% by weight of oil or diesel droplets. Even 1% diesel oil provides the alcohol, especially methanol, with sufficient ignitability. The at least 3-8% by weight of oil or diesel fuel shows a

i.e. the oil or diesel content and the flow rate, in a compact manner, although two separate sensors can also be used.

In particular, no further treatment for comminution, such as further grinding processes or the like, takes place between the cavitator and the discharge.

In particular, the cavitator can be designed as a nanocavitator.

The treatment in step B or C can advantageously be carried out at a temperature of more than 25°C, preferably between 30-45°C, particularly preferably between 35-40°C.

A run through a cavitator can preferably take 1-10 seconds. The runs can be repeated several times or several cavitators can be connected in series.

The emulsion from step C and the mixture from step B can be circulated, with a maximum of 50% by weight, preferably a maximum of 35% by weight, of the total weight of emulsion and mixture being continuously or discontinuously circulated out of the circuit. As a result, part of the emulsion remains in the circuit, which facilitates renewed emulsion formation when alcohol and oil in the form of triglycerides, in particular vegetable oil, or diesel fuel are present.

A device for carrying out the method according to the disclosure comprises a container, at least one cavitator and a discharge line which is connected to an internal combustion engine, wherein the device has a control and/or evaluation unit which is designed to carry out the method according to the disclosure. In particular, the aforementioned unit controls or regulates the method in such a way that alcohol and oil or diesel fuel are metered in as a mixture, as a result of which the aforementioned oil- or diesel-in-alcohol emulsion is formed.

Optionally, a recirculation line can also be provided from the outlet of the cavitator to the tank so that the oil- or diesel-in-alcohol emulsion can be circulated through the cavitator several times.

The device can be advantageously designed in such a way that a sensor transmits measurement data to the control and/or evaluation unit to control the amount

of oil and alcohol fed into the device. This can preferably be a flow sensor and/or a fill level sensor.

It has been shown that a high degree of efficiency can be achieved with a high temperature difference between the solvent components. It is therefore advantageous if the non-polar solvent is cooled to below 12°C, preferably below 10°C, before it is used.

Further in accordance with the disclosure is the use of an oil- or diesel-in-alcohol emulsion as a fuel for a self-igniting internal combustion engine or for its operation.

In another aspect, the disclosure provides use of an oil- or diesel-in-alcohol emulsion, preferably produced as described herewith, as a fuel for a self-igniting internal combustion engine.

In the context of the present disclosure, it was also surprisingly found that an oil-in-alcohol emulsion can also be used as a fuel or propellant despite the low ignitability of methanol as a component.

Fig. 1 Schematic diagram of a device for producing a multiple emulsion.

Fig. 1 shows a device 100 for producing a diesel oil-methanol multiple emulsion. Here, a first polar solvent 4 in the form of an alcohol, such as methanol (MeOH), and a non-polar solvent 3 in the form of oil are fed together into a container 13, for example a tank with an agitator. Optionally, a second polar solvent, e.g. water 9, can be added, although the proportion of the first polar solvent predominates over the second polar solvent. At least one of the two polar solvents is an alcohol, preferably methanol. Although methanol has a low flash point, it has a high ignition temperature and is therefore actually unsuitable for use as a fuel in internal combustion engines in large quantities.

Preferably, the container is heated so that the temperature of the solvent mixture can be brought to and maintained at a temperature of more than 25°C, preferably between 30-45°C, particularly preferably between 35-40°C.

In the case of alcohols, such as methanol or other short-chain alcohols, in particular with less than or equal to 4 carbon atoms, its preferred proportion in the

multiple emulsion can also be more than 30% by weight, particularly preferably more than 50% by weight, in particular 51-95% by weight, and thus significantly higher than conventional ethanol blends in gasoline fuels.

CLAIMS:

1. Method for producing an oil- or diesel-in-alcohol emulsion for use in a self-igniting internal combustion engine, an internal combustion engine and/or a system for generating energy, **characterized by the following steps of:**
   A providing a solvent mixture comprising an oil and/or a diesel fuel and a polar solvent in the form of an alcohol;
   B treating the mixture from step A with at least one cavitator to form an emulsion, and
   D transferring the emulsion to the self-igniting internal combustion engine ,
   wherein the method further comprises the following step between steps B and D:
   C repeating step B at least once to form a multiple emulsion, preferably by guiding the emulsion in a circuit,
   wherein treatment in C takes place in a working range from more than 6 bar up to a maximum of 75 bar.

2. Method according to claim 1, **characterized in that** the emulsion is formed in step B without the addition of emulsifier or surfactants.

3. Method according to claim 1 or 2, **characterized in that** the circuit preferably has a conductivity sensor between a container with supplied solvent mixture and the cavitator for determining the conductivity of the solvent mixture supplied to the cavitator, wherein the supply of further solvent mixture into the circuit takes place as a function of the determined conductivity.

4. Method according to claim 1, 2 or 3, **characterized in that** the only non-polar component of the solvent mixture is the diesel fuel.

5. Method according to one of the preceding claims, **characterized in that** the alcohol is a monohydric short-chain alcohol having a number of carbon atoms in the molecule of less than or equal to 4.

6. Method according to one of the preceding claims, **characterized in that** the oil or diesel fuel-in-alcohol emulsion provided in step C is emulsifier-free and surfactant-free.

7. Method according to one of the preceding claims, **characterized in that** the emulsion in step C comprises at least 1% by weight of oil or diesel droplets, preferably at least 3-8% by weight of oil or diesel droplets.

8. Method according to any one of the preceding claims**, characterized in that** the oil or diesel droplets in the oil- or diesel fuel-in-alcohol emulsion after the treatment in step C have an average diameter of less than 0.6 µm, preferably 0.1 µm to 0.5 µm.

9. Method according to one of the preceding claims, **characterized in that** the transfer time after completion of the treatment of the mixture in the cavitator to the internal combustion engine is less than 4 minutes, preferably less than 2 minutes.

10. Method according to one of the preceding claims, **characterized in that** steps A-D are carried out in a device for producing the emulsion, wherein the device comprises
    a. a container for forming the mixture according to step B,
    b. at least one cavitator for forming the oil- or diesel-in-alcohol emulsion according to step C and
    c. a branch with a branch line connected to it for discharging the emulsion from the circuit and transferring it into the internal combustion engine,

    wherein the device further comprises the conductivity sensor, which is arranged between the container and the discharge line.

11. Method according to one of the preceding claims, **characterized in that** the feed of oil or diesel fuel and alcohol into the container is controlled by means of sensor-detected measurement data, in particular with regard to the feed quantities of oil or diesel fuel and alcohol, and/or the conductivity and/or the density of the emulsion in the circuit.

12. Method according to one of the preceding claims, **characterized in that** the at least one cavitator is designed as a nanocavitator.

13. Method according to one of the preceding claims, **characterized in that** the treatment in step B or C is carried out at a temperature of more than 30°C, preferably between 40-60°C, particularly preferably between 45-55°C.

14. Method according to one of the preceding claims, **characterized in that** no further treatment takes place between the cavitator and the branch line.

15. Method according to one of the preceding claims, **characterized in that** the treatment in step B or C takes place in a working range of more than 10 bar to a maximum of 75 bar, preferably from 60 bar to a maximum of 75 bar or from 12 bar to a maximum of 20 bar.

16. Method according to one of the preceding claims, **characterized in that** the emulsion and the mixture are circulated, wherein a maximum of 50% by weight, preferably a maximum of 35% by weight, of the total weight of emulsion and mixture are continuously or discontinuously circulated out of the circuit as emulsion.

17. Method according to one of the preceding claims, **characterized in that** to reduce the NOX and CO exhaust gas values, water is added in step A, preferably to less than 20% by weight based on the total weight of the emulsion.

18. Method according to one of the preceding claims, **characterized in that** the non-polar solvent is cooled before use, preferably to 10°C, more preferably to 12°C below the temperature of the polar solvent.

19. Use of an oil- or diesel-in-alcohol emulsion, preferably produced according to one of the preceding claims, as a fuel for a self-igniting internal combustion engine.