TECHNICAL BRIEF

OIL-WATER EMULSION BREAKING TECHNOLOGY

OrganoCat owns a commercially-practiced technology that is applicable for breaking emulsions of oil-in-water and water-in-oil, and removal of solids from the oil-water interface. This technology also allows for the separation of oil from water and water from solids, enabling the recycling of water for technical/ technological applications.

Our technology is based on a novel acoustical method and apparatus application. This method includes treatment of any viscous and heavy liquid by low frequency acoustical waves. The process is conducted in a vibro-acoustical apparatus. The apparatus is compatible with various mechanical treatments, resulting in highly viscose, tight and heavy emulsion/ suspension treatment.

The unique aspects of this technology and apparatus are based on both physical properties of the low frequency/ long wave length mechanical/ hydrodynamic/ acoustical movements, jets and waves and the novel design of the vibro-acoustical apparatus. The first is a fundamental property of the low frequency waves to work over a reactor length without significant adsorption and dissipation into liquid media and to be radiated into any viscous and heavy emulsion/ suspension. There is no significant vibration of the reactor's walls or constructive elements. No significant noise results from the process. The second fundamental property is a special design which forms low frequency waves, hydrodynamic small and larger scale (μm to cm) fluctuation and turbulence, micro- and macro-pulsation and oscillation, dynamic pressure, etc. These act to destabilize the oil-water interface with colloidal and other solid fractions. Once the constituents are destabilized, the water, oil and solids coalesce and collect into layers resulting in oil, water and solids separation. The treatment takes several minutes to complete and tens of minutes for the emulsion to completely separate into distinct layers. The treatment significantly reduces the emulsion viscosity.

There are amphiphilic hydrocarbon molecules which work as a surfactant and colloidal mineral particles which are the cause of extremely stable oil-water-solids emulsion formation. Microbiological processes may also play some role in stable emulsion formation due to its ability to reduce the interfacial tension between oil, water and solids. Inexpensive, available and recyclable reagents can be used to increase the efficacy of the emulsion separation to oil, water and solids. One of them increases the oil's hydrophobicity, resulting in higher repelling forces between oil and water. Concurrently, this reagent repels water from the oil and increases the interfacial tension between oil and solids and drives solid particles into the water phase. Another reagent collects the water droplets into

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the water phase and also drives solid particles to the water phase. Once they are driven into the water phase, solids are available for separation from water through precipitation, filtration, centrifugation, etc. Finally, this method and apparatus breaks the oil emulsion, creating a separation between oil and water with solids and is robust across a wide range of material viscosity. Cost to operate the device is very low.

Demonstrated Examples:

A lab scale test was recently conducted with an oil-in-water emulsion. The material density was approx. 0.95 gr/cm^3 and viscosity was approx. 2400 cP. Referencing pictures 1, 2 and 3 enclosed: Picture 1 is the initial emulsion before treatment; Picture 2 is the same emulsion after treatment (notice light passes through the water phase); Picture 3 shows the emulsion separated into oil, water and solids. The treatment took several minutes and separation/precipitation took approx. 30 minutes.

Picture 1: Initial oil-water emulsion before treatment

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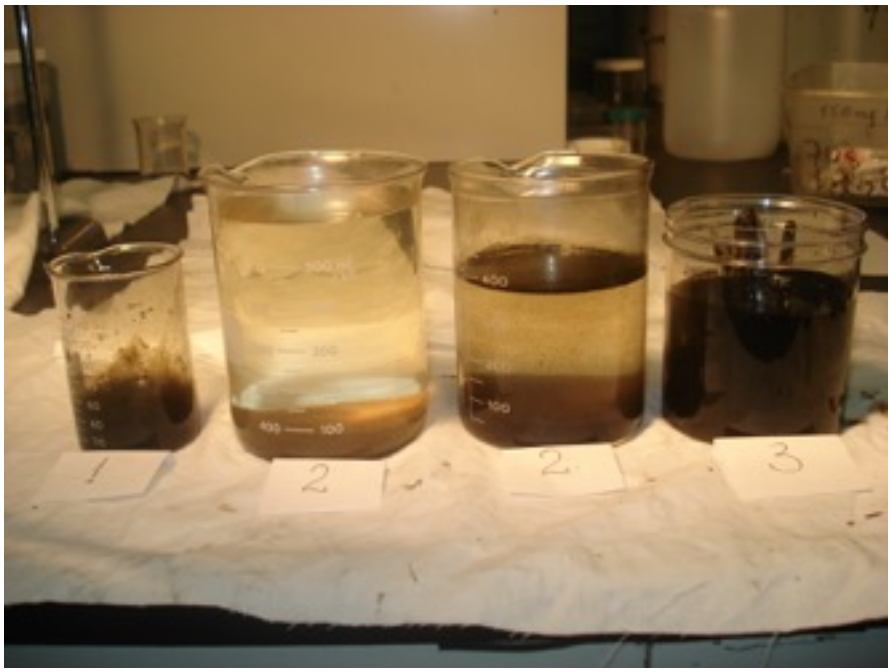
Picture 2: Oil-water emulsion after treatment.



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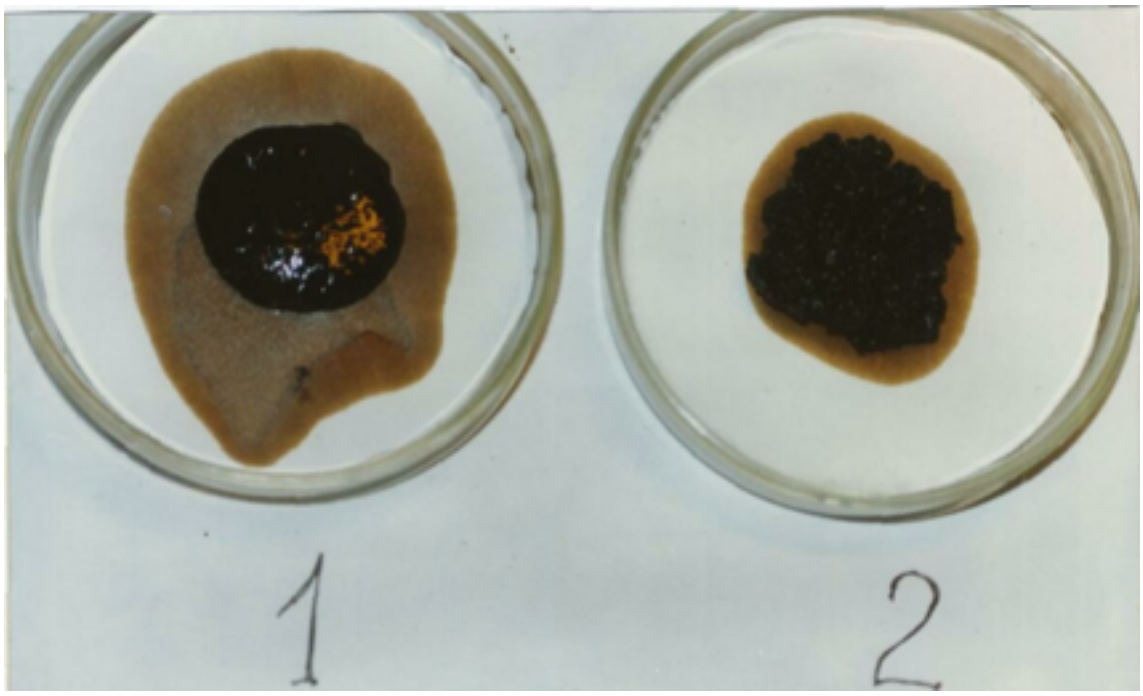
Picture 3: Separation of different fractions in the oil-water emulsion after treatment.

In another experiment, highly viscous and “sticky” oil containing sludge (oil refinery processing waste stored for several decades) was treated. Please note that the initial material was unable to be pumped. Picture 4 illustrates the starting material. Picture 5 illustrates the material after treatment for several minutes with approx. 30 minutes of separation/settling time. Two reagents were used. Both of them are recyclable.



Picture 4: Materials 1 and 2 illustrate highly viscous and “sticky” oil containing sludge from decades of storage prior to treatment with the vibro-acoustical apparatus.

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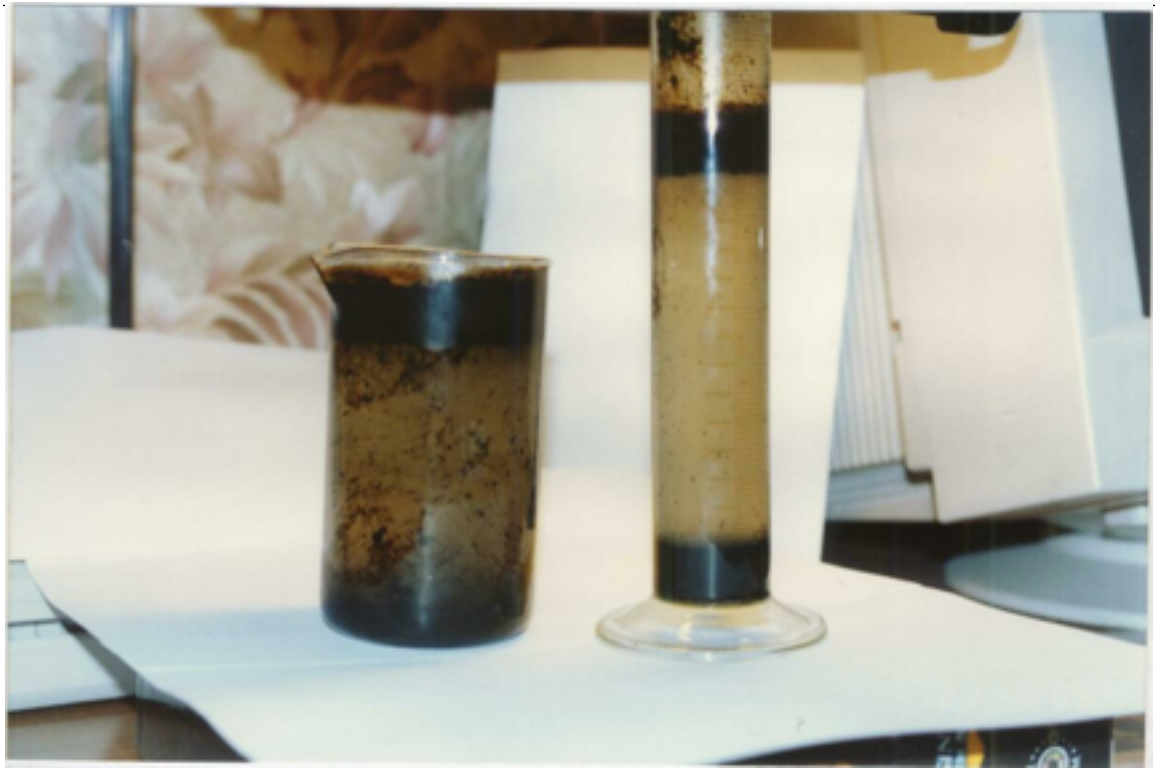

Picture 5: Material illustrated in Picture 4 after treatment with the vibro-acoustical apparatus. Left beaker is sample 1 and right beaker is sample 2 in picture 4.

A pilot scale vibro-acoustical apparatus exists with capacity of ~ 1000 liters (or 275 gallons) per hour and is available for testing. This device can be designed for implantation into an already existing pipeline to treat oil emulsion flow and separate oil from water and solids.

The method and apparatus are owned by OrganoCat, classified as a commercial secret and patentable.

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