# Time Dependent Behaviour of Water-in-Oil Emulsions Stabilised by Hydrophobised Bacterial Cellulose Nanofibrils

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Cellulose is the most abundant organic polymer in nature. It can be derived from plants, synthesised by the sea animal tunicate or bacteria from the *Acetobacter* species. Cellulose fibrils synthesised by bacteria is of particular interest as bacterial cellulose exists naturally as a nano-sized material (24-86 nm in diameter, several micrometres in length) and it is highly crystalline in nature. It is well known that cellulose particles such as microcrystalline cellulose (MCC) and microfibrillated cellulose (MFC) have the ability to stabilise emulsions. MCC, in particular, has been used as an emulsifier in its colloidal form. Recently, hydrophobised MFC particles were shown to stabilise water-in-oil (w/o) emulsions [1]. Neat bacterial cellulose has also been shown to stabilise oil-in-water (o/w) emulsions [2]. However, no studies were made on the emulsifying ability of hydrophobised bacterial cellulose nanofibrils.

Therefore in this work, we investigate the properties of the (w/o) emulsions stabilised by hydrophobised bacterial cellulose nanofibrils. It was found that the emulsions stabilised by organic acid modified bacterial cellulose nanofibrils exhibited a time dependent behaviour. The maximum internal phase volume the emulsions at the point of catastrophic phase separation increased with time from 50 vol% to as high as 82 vol%. In addition to this, the w/o emulsions also exhibited a reversible behaviour, meaning the emulsion can be destroyed and reformed repeatedly. We attribute these properties to the swelling effect of the hydrophobised bacterial cellulose nanofibrils by the oil phase and water, which led to a change in hydrophobicity as a function of time.

**References:**

[1] Andersen M, Stenius P. *J. Disper. Sci. Technol*. **2007**; *28 (6)*: 837-844.
[2] Ougiya H, Watanabe K, Morinaga Y, Yoshinaga F. *Biosci. Biotech. Bioch.* **1997**; *61 (9)*: 1541-1545.