

## Modification of clay liners to improve barrier capabilities for hypersaline leachates

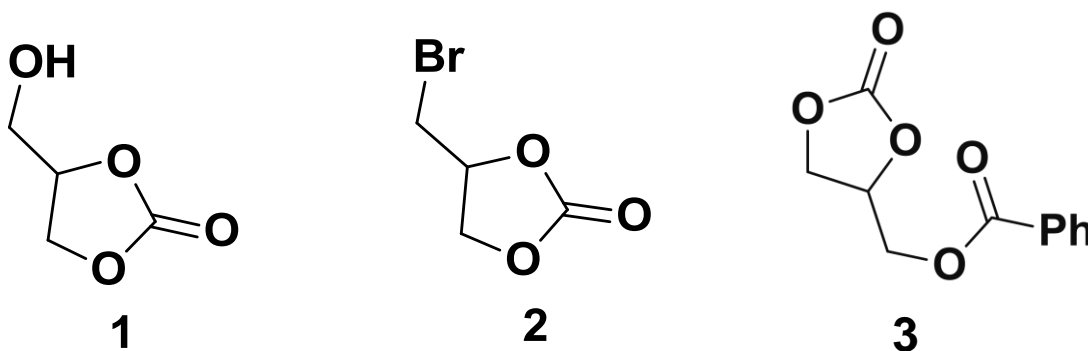
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Organo-clay composites have potential applications in geosynthetic clay liners to provide protection against loss of the hydraulic barrier under hypersaline conditions (Gates, 2004). It has been reported that propylene carbonate complexes of Na-bentonite exhibit lower permeability to waters up to 1M salinity compared to Na-bentonites (Katsumi et al., 2008). Glycerol carbonate (GC, Molecule 1) and related cyclic carbonates have not been investigated as clay modifiers, but their chemistry, dielectric constants, dipole moments and solubility parameters suggest that they may be potential candidates (Chernyak, 2006). In particular, glycerol carbonate exhibits low toxicity, a high dielectric constant, a high boiling point and can be synthesized from cheap and readily available glycerol (a by-product of soap and biodiesel production). We have now synthesised GC via a green chemistry route from glycerol and urea in the presence of a zinc monoglycerolate catalyst. Subsequent chemical conversion into useful derivatives (e.g., 4-bromomethyl-1,3-dioxolan-2-one (Molecule 2)) has also been possible through functionalization of the hydroxyl moiety.



Intercalation of a range of glycerol carbonate derivatives has been achieved with sodium montmorillonite. The resulting intercalates have been characterised spectroscopically and by powder X-ray diffraction, showing comparable results to propylene carbonate. Intercalation of GC by Na montmorillonite increased the d(001) from 1.58 to 1.99 nm, in comparison with propylene carbonate d(001) = 1.97 nm, 4-bromomethyl-1,3-dioxolan-2-one, d(001) = 1.96 nm and 4-methylbenzoate-1,3-dioxolan-2-one (Molecule 3) d(001) = 1.99 nm.

The mechanism of intercalation is presumed to be via H-bond interactions with the primary shell of hydration water surrounding exchange cations (Katsumi et al., 2008). Durability tests in 1 M NaCl solutions indicate that the complex is stable for at least one year.

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### **References**

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