



Contamination Assessment and
Remediation of the Environment

Bio-reactive Organoclays for Organic Contaminants Remediation

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Concept of organoclay

Toxic organic compounds in soil and water environment are of increasing environmental and human health concern globally. These contaminants are perhaps most prevalent of all anthropogenic contaminants in the environment.

Clay based remediation materials can effectively immobilize those contaminant compounds.

Advantages of natural clay sorbent

- ❖ Inexpensive and local availability
- ❖ Environmental stability
- ❖ High sorption capacity

Disadvantages of natural clay sorbent

- ❖ Highly hydrophilic
- ❖ Low adsorption for hydrophobic organic contaminants

High sorption of organics can be achieved by introducing organic surfactants on clay surfaces. Surfactant modified clays are known as organoclays.

Potential clay members for organic modification

- ❖ Bentonite
- ❖ Montmorillonite
- ❖ Kaolinite
- ❖ Palygorskite
- ❖ Zeolite

Obstacle for commercial use of organoclays

- ❖ Regeneration of organoclays
- ❖ Disposal of sorbed contaminants

Bio-reactive organoclay

Bio-reactive organoclay are prepared by combining certain microorganisms with organoclay. While the organoclay immobilizes the contaminants, added microorganisms degrade them.

Challenges for bio-reactive organoclay technology

- ❖ Selection of surfactant modifier that can promote incorporation and growth of microbial species
- ❖ Isolation of micro-organisms that target the contaminant only and can thrive on surfactant modified clays
- ❖ Availability of organo-clay immobilized contaminants to microorganisms
- ❖ Knowledge and technology to combine the microorganism with clays to present them in an application ready form

Aim of the PhD research

To synthesise/modify the clays for their ability to remediate organic pollutants

Image: SEM micrographs of (a) unmodified and (b) organocally modified montmorillonites

Figure: Name, common abbreviation and structure of some organic surfactant cations used in organoclay production

Table: Some organo-modified clays and their sorption ability for pollutants

References

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Acknowledgement

- University of South Australia
- CRC CARE-CRC for Contamination Assessment and Remediation of the Environment

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Image: SEM micrographs of (a) unmodified and (b) organoclay modified montmorillonites

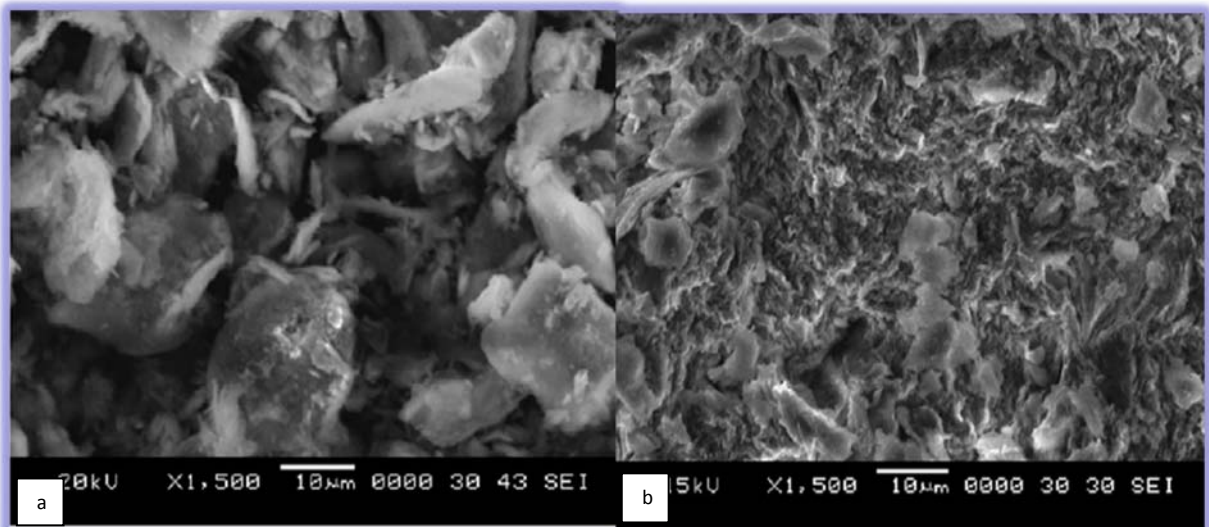


Figure: Name, common abbreviation and structure of some organic surfactant cations used in organoclay production

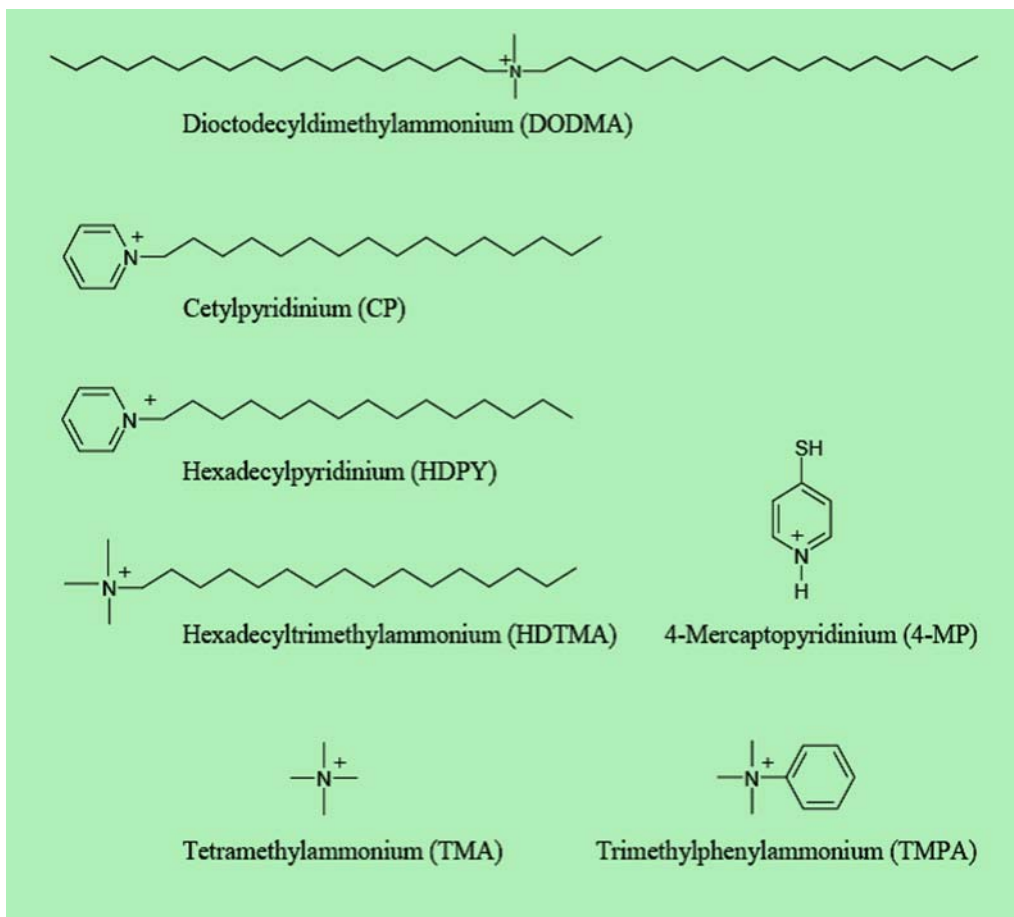


Table: Some organo-modified clays and their sorption ability for pollutants

Clay	Surfactant	Contaminant	Reference
Montmorillonite	CP	PAH Pentachlorophenol	Ake et al. 2003
Bentonite	HDTMA	TCE Benzen Dichlorobenzene	Bartelt- Hunt et al. 2003
Montmorillonite	HDTMA	Fenamiphos	Singh et al. 2004
Montmorillonite	ODTMA	Diesel Hydraulic oil	Carmody et al. 2007
Hydrotalcite	DCS	Carbetamide Metamitron	Bruna et al. 2006
Palygorskite	ODTMA	Penconazole Linuron Alachlor	Sanchez- Martin et al. 2006