

UNDERSTANDING HYDROPHOBIC CLAY BASED GEOPOLYMERS

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What is the feasibility of clay based geopolymers as a waterproof solution in wet construction areas?

Due to the effect of cement on the environment being a contributor of 5% to 7% of global CO2 emissions, studies on alternatives to cement has been done and Geopolymers has a promising potential.

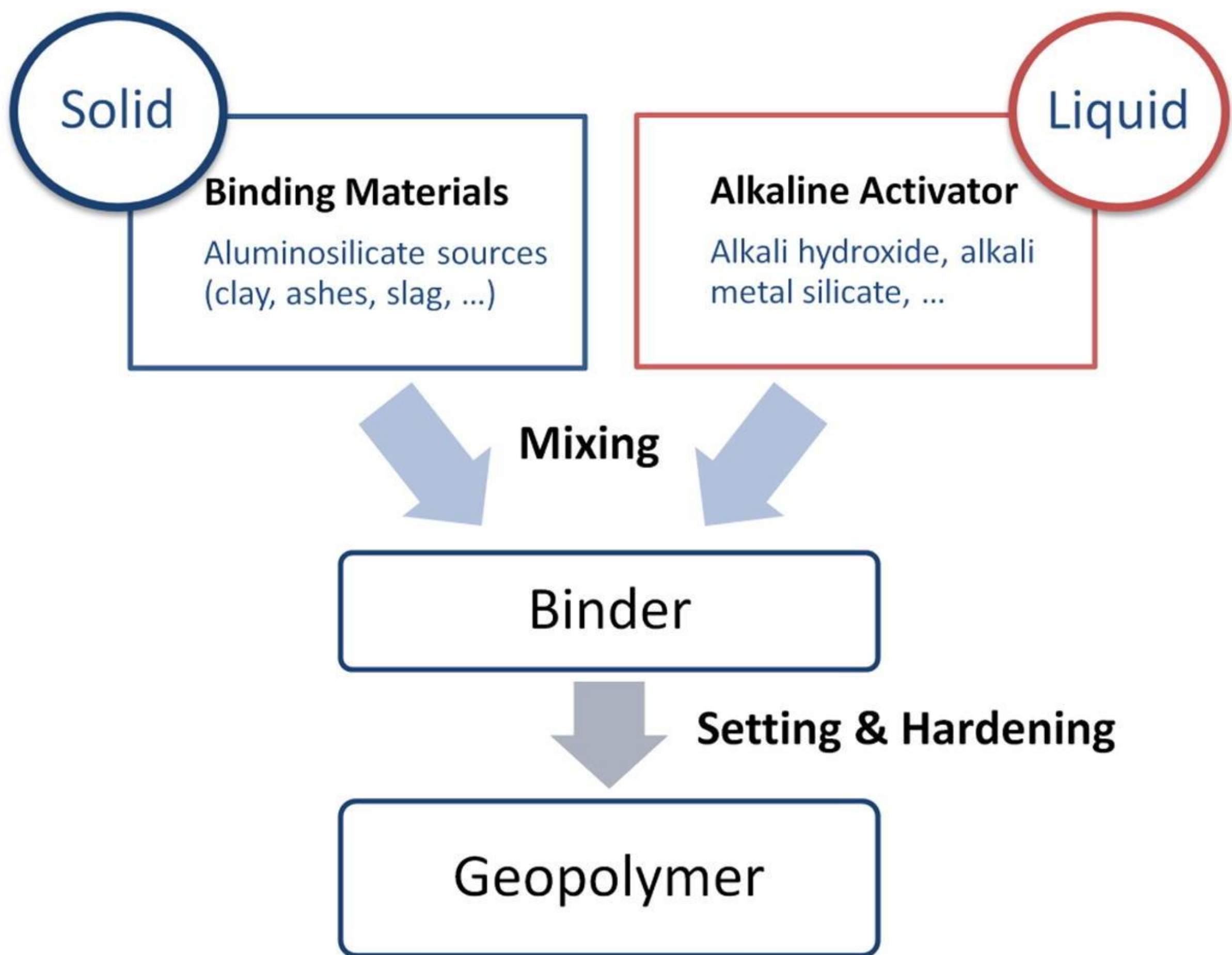


Figure 1: process of geopolymer formation (L. Yun-ming, et al, 2016)

Geopolymers are inorganic polymers consisting of a solid source rich in aluminosilicates such as clay combined with an alkaline activator such as silicates and hydroxides of sodium which creates a binder for the aggregates to create the geopolymer.

LOCAL CLAY IN ZEELAND

The clay used is collected regionally in the city of Ritthem specifically in the OEST farm.

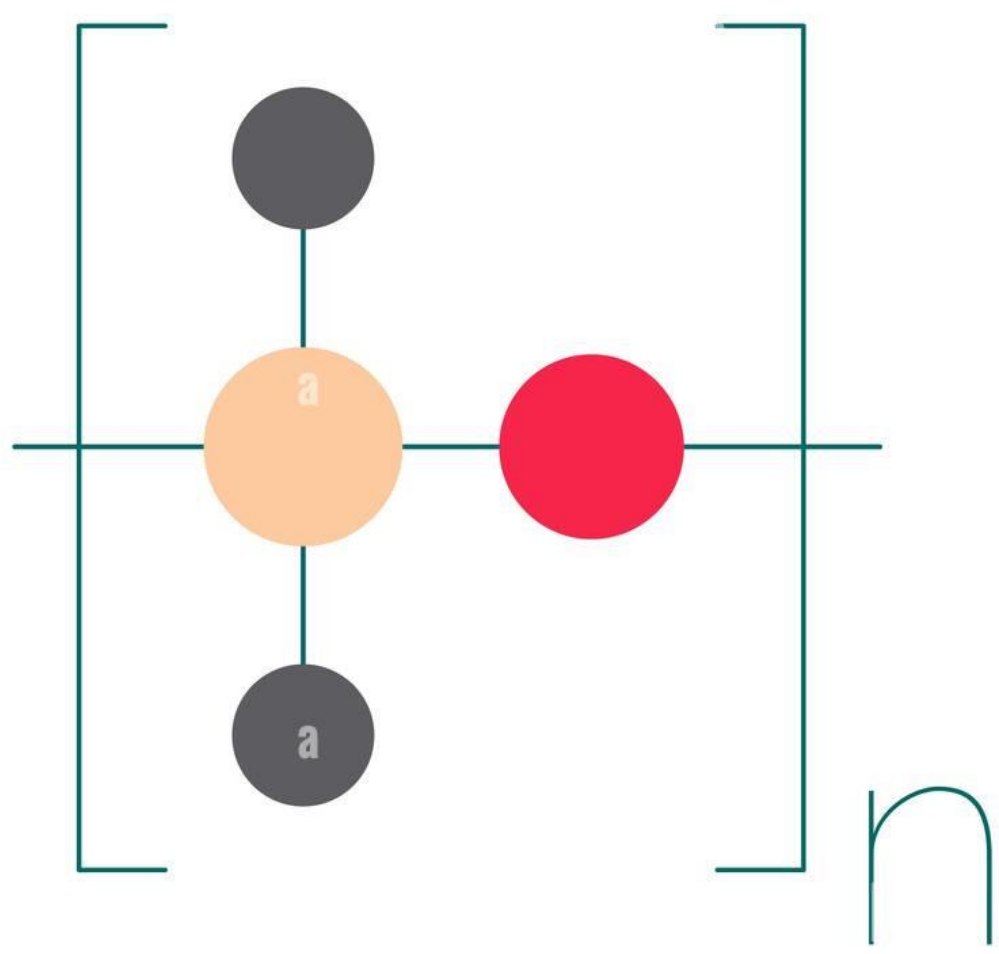


Figure 2:Clay from OEST Farm

The clay used has great characteristics such as being low in salinity, as well as low in organic material and the type of clay potentially used is Montmorillonite-Smectite which is rich in Aluminosilicates.

Polydimethylsiloxane (PDMS)

Unfortunately, Geopolymers are known to be hydrophilic due to porosity that ranges from 20% to 40% and polycondensation creating pathways for water transportation, PDMS is a chemical that enhances hydrophobicity by modifying the microstructure and surface energy.



polydimethylsiloxane



Figure 3: chemical composition of PDMS (S. Ruan, et al, 2021)

TESTS PERFORMED

A set of tests shall be performed to ensure the hydrophobicity the main tests performed are the water contact angle, capillarity test and water absorption.

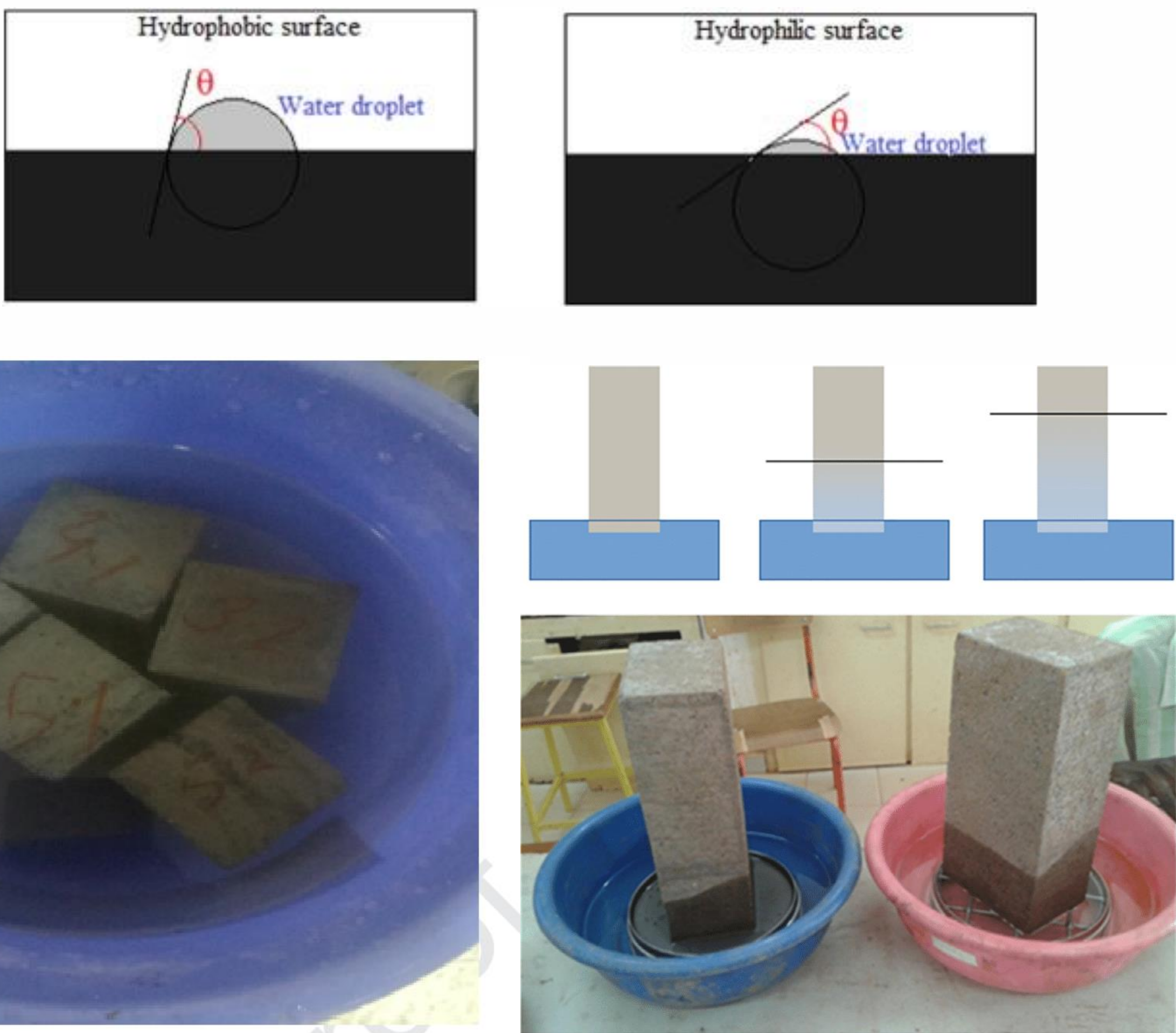


Figure 4: examples of testing water resistance within tiles (L.Abdou, et al, 2019)

References

- 1.Bill Kerr. (2012). Clay soils cultivation: a beginner's guide, [Clay soils cultivation: a beginner's guide](#).
- 2.Yun-Ming Liew, Cheng-Yong Heah, Al Bakri Mohd Mustafa, Hussin Kamarudin. (2016) Structure and properties of clay-based geopolymer cements: A review. Progress in Materials Science. Volume 83, Pages 595-629, ISSN 0079-6425. <https://doi.org/10.1016/j.pmatsci.2016.08.002>.
- 3.Ruan, S., Chen, S., Zhu, X., Zeng, Q., Liu, Y., Lai, J., & Yan, D. (2021). Matrix wettability and mechanical properties of geopolymer cement-polydimethylsiloxane (PDMS) hybrids. *Cement and Concrete Composites*, 124, 104268. <https://doi.org/10.1016/j.cemconcomp.2021.104268>