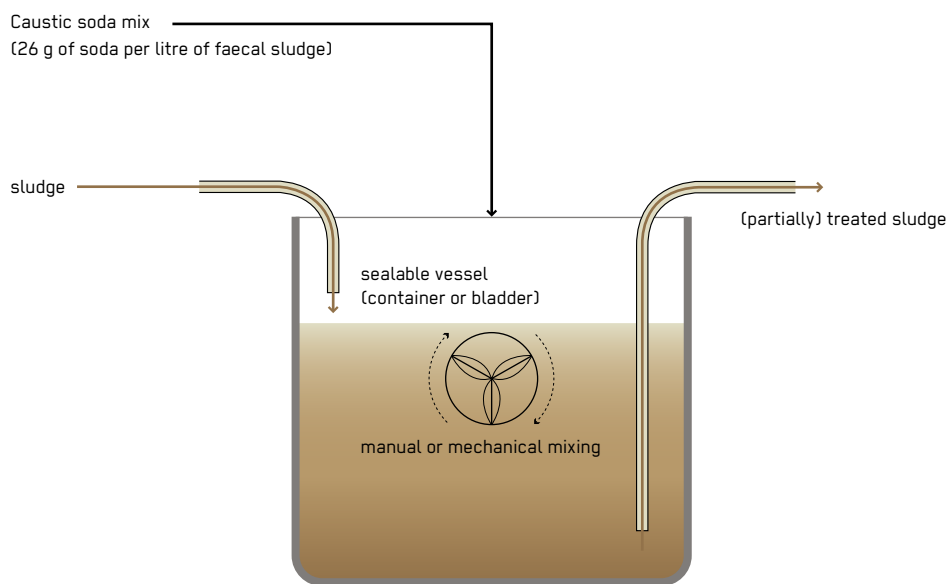


Caustic Soda Treatment (Emerging Technology)

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
** Acute Response * Stabilisation Recovery	Household ** Neighbourhood City	Household Shared ** Public	Pathogen removal, Minimising immediate public health risks
Space Required	Technical Complexity	Inputs	Outputs
* Little	** Medium	● Blackwater, ● Sludge	● Treated Effluent, ● Treated Sludge



Caustic Soda Treatment is a cost-effective chemical treatment for faecal sludge from pits and trenches. It uses caustic soda also known as lye (sodium hydroxide: NaOH) as an additive to create a highly alkaline environment and thereby sanitises sludge from human waste. It significantly reduces the public and environmental health risks of latrine sludge.

Caustic soda is a white, alkaline, odourless material supplied as flakes packed in drums. It is used to increase the pH of blackwater or sludge and create a highly alkaline environment that destroys pathogens. The optimum dosage to reach the recommended pH of 12 is around 26 g of soda per litre of faecal sludge. The exact amount, however, depends on the characteristics of blackwater or sludge. Its effect can be enhanced by ensuring complete mixing, a longer contact time and a higher dosage of caustic soda. The pH should be maintained above pH 12 for a minimum of 2 hours to ensure an adequate reduction of pathogens.

The Caustic Soda Treatment process should be undertaken as a batch process and can be used to treat both solid and liquid sludge. After treatment, pH decrease towards neutral usually within 24 hours. After neutralisation, the supernatant can be pumped off and safely infiltrated into a Soak Pit (D.10). Care should be taken in areas with high a groundwater table as the supernatant still contains nitrogen and phosphorous which can pollute water bodies. The treated solid fraction at the bottom may be applied as a soil amendment or dried and used as cover for sanitary landfills.

Design Considerations: Caustic Soda Treatment can either take place above ground in a separate tank or below ground. In areas with a high groundwater level or in flood prone areas it is recommended to always use above ground tanks. Separate tanks may be needed for the preparation of the soda solution slurry and for the post-neutralisation of the treated effluent respectively.

Materials: Caustic Soda Treatment needs a reactor vessel that can either be an above ground tank (between 1–30 m³) or a pit below ground with tarpaulin lining. An additional smaller container is needed for the preparation of the caustic soda solution (e.g. 200 L plastic drum). For an even distribution of caustic soda in the tank it is mixed into the sludge either manually or using a mixing pump. The type of pump required depends on the consistency of the sludge. A separate pump is needed for removing the treated effluent from the tank and a shovel or vacuum pump for the removal of solid material. In addition a water testing kit (particularly for pH, E.coli, total suspended solids and turbidity) is needed as well as personal protective equipment (PPE) including a mask, gloves, boots, an apron or safety suit. A steady supply of caustic soda is also required.

Applicability: Caustic Soda Treatment is particularly suitable for the rapid response phase due to its short treatment time, simple process and use of readily available materials. With trained and skilled staff, it allows for a safe, cost-effective and extremely fast treatment of faecal sludge.

Operation and Maintenance: Caustic Soda is corrosive due to its high alkalinity, therefore a regular maintenance of pumps is required. During storage, caustic soda must be kept dry at all times because it absorbs and reacts with water. Due to potential health risks when handling caustic soda (see below) skilled and trained personnel must follow respective health and safety protocols and wear proper PPE.

Health and Safety: Caustic Soda is corrosive to the skin, eyes and lungs. Adequate PPE must be worn when handling it to prevent irritation to eyes, skin, respiratory system, and gastrointestinal tract. The occupational

exposure limit for caustic soda is 2 mg per cubic meter for a 15-minute reference period. Washing with cold water is recommended for affected skin and eye areas followed by rinsing with borax-boric acid buffer solution. Medical attention should be sought. Protection from fire and moisture must be ensured. Caustic soda is an alkaline material which reacts strongly with moisture. Trained personnel must follow health and safety protocols.

Costs: Caustic Soda Treatment is a relatively cheap treatment option. In general, caustic soda is twice as expensive on the market as lime (S.17). Costs may vary depending on the availability and costs of local materials and chemicals/soda. As part of a proper health risk management, costs for PPE and respective trainings for staff need to be considered.

Social Considerations: Proper health and safety protocols should be in place and include the provision of PPE and respective trainings for involved staff.

Strengths and Weaknesses:

- ⊕ Short treatment time (6 log removal of E-coli in < 1day i.e. pathogen count is 1 million times smaller)
- ⊕ Simple process which uses a material that is available in most countries
- ⊕ For liquid sludge, a sanitised and stabilised effluent is created suitable for soil infiltration
- ⊖ Mixing is essential for the process
- ⊖ Highly-alkaline sludge and effluent created – requires subsequent neutralisation
- ⊖ Potential health risks if not handled or stored properly

→ **References and further reading material for this technology can be found on page 192**