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# Optimizing dewaterability of drinking water treatment sludge by ultrasound treatment: Correlations to sludge physicochemical properties

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**Abstract:** Sludge dewatering has proven to be an effective method to reduce the volume of sludge. In this study, drinking water treatment sludge (DWTS) was treated by ultra-sonication under variable conditions comparing two sonoreactor types (bath and probe), four frequencies(25, 40, 68, 160 kHz) and four energy density levels(0.03, 1, 3, 5W/mL). The effects of these conditions were studied using specific resistance to filtration and capillary suction time as measures of dewaterability, and floc size, the Brunauer, Emmett and Teller (BET) specific surface area and Zeta potential to determine treated sludge characteristics. The results indicated that the dewaterability of sonicated sludge improved at relatively low energy densities of 0.03 and 1.0 W/mL, while an optimum for sonication duration (within 10min) was also identified. Higher frequencies (tested up to 160 kHz) with acoustic energy density of 0.03 W/mL also reduced the dewatering property. At higher energy densities of 3.0 and 5.0 W/mL, dewaterability of sludge deteriorated regardless of ultra-sonication time, with an increase of solubilized organic matter content and severely changed floc characteristics. The deterioration of the dewatering capacity was closely related to the considerably reduced floc sizes, dissolution of proteins and polysaccharides, and to the Zeta potential of sonciated sludge flocs. The dewaterability was not correlated with BET specific surface area. Mechanistic explanations for the observations were discussed by analyzing corrosion patterns of aluminum foil as a measure for cavitation field distribution.

**Keywords:** Drinking water treatment sludge; Dewaterability; Solubilized organics; Ultrasound; Correlation

## 1 Introduction

A typical byproduct resulting from the production of drinking water by use of aluminum or iron-based salts as coagulants is sludge that collects in the primary settling tanks and backwash drainage of filters [1]. Disposal of this drinking water treatment sludge (DWTS) depends on local conditions and customs, and may include reuse as building materials, burial into soil, application to farmland, sanitary landfills or ocean disposal [2, 3]. The most common disposal strategy in China is burying DWTS in deserted soils and sanitary landfills. However, prior to disposal, efficient dewatering of the sludge is of paramount importance as a reduced volume and weight results in lower management, transport and disposal costs. In addition to reducing waste disposal, the reuse of DWTS could contribute to improving coagulation and absorption