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Rheological behaviour of residues in dry anaerobic digestion performed by Vane geometry

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The knowledge of the rheology of residues involved in dry digestion is an essential factor for process optimization. Despite this fact, it is difficult to characterize the rheological behaviour of these residues with high total solid (TS) content. Indeed, the standard methods of rheological measurements are poorly adapted to these residues because of the sliding effects observed during the measurements. In this study, we used a non-standard method, the Vane geometry, for its particularity to limit the sliding effects. Two types of measurements were carried out on potato residues of 18 to 35% TS, extracted from the digesters. The first measurement was to submit to the sample a rising shear velocity ramp from 0 to 200 s-1 at 37℃ and 55℃. The results of these measurements show a good correlation between the rheograms and Herschel-Bulkley model and we deduced a rheofluidifying threshold behaviour. The second measurement was performed in oscillations at 10 Hz at 25℃, 37℃ and 55℃. The results show different evolutions of the elastic G' and viscous G'' modulus as a function of temperature. There is a crossing of G' and G'' at 25℃, G' greater than G'' at 37℃, and finally G' and G'' forming a plateau at 55℃, characteristic of a gel. The knowledge of these rheological behaviour is crucial for the design and operating instructions of anaerobic digestion reactors for residues with high TS content. The Vane geometry would, therefore, be an effective tool for characterizing the rheological behaviour of residues in dry digestion.

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