Electronic Supplementary Material (ESI) for Green Chemistry.

Supporting Information

NaCl-promoted phase transition and glycosidic bond cleavage under microwave for energy-efficient biorefinery of rice starch

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Text S1. Rice starch conversion in FlexiWAVE

In a typical conversion experiment, the substrate, i.e., rice starch (Sigma Aldrich) of 2 g, was added to a Teflon vessel (100 mL) containing 40 mL water with the NaCl concentration of 0-20 wt.% (with respect to water), followed by magnetic stirring to obtain a homogeneous mixture. The mixture was then heated in a FlexiWAVE microwave reactor (Milestone) with a fibre optic sensor inserted in the vessel centre, which measured the internal temperature to achieve programmed heating by varying power output. A constant ramp rate of 32 ^{o}C min^{-1} was used, which normally allowed well-controlled temperature increase without overshoot. Heating at the target temperature of 180-200 ^{o}C was kept for 15 min, followed by forced ventilation to cool the reaction vessels to room temperature. Liquid samples were subjected to product analysis after a four-fold dilution in water and filtration through a 0.2-μm regenerated cellulose membrane.

Text S2. Preparation and conversion of pre-gelatinised starch in FlexiWAVE

Starch (2 g) was pre-gelatinised via ramping to 200 ^{o}C (no holding time) in 40 mL water in FlexiWAVE. After cooling to room temperature, the starch gel was retained in the reaction vessel, and $NaCl_{(s)}$ was added (loading = 1 wt.% with respect to water), followed by thorough mixing with a glass rod. The mixture was then heated in FlexiWAVE for 15 min at a reaction temperature of 190 ^{o}C, following the procedures described above. A control experiment was carried out with the same protocol in the absence of salt.

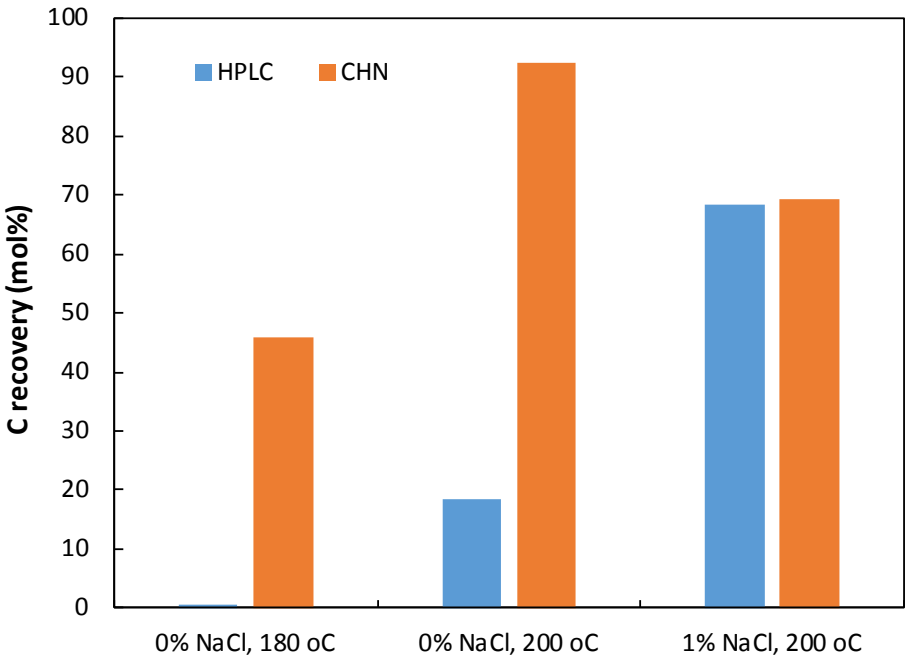

Figure S1. Carbon recovery revealed by HPLC and CHN analyses for starch conversion for a holding time of 15 min in FlexiWAVE.

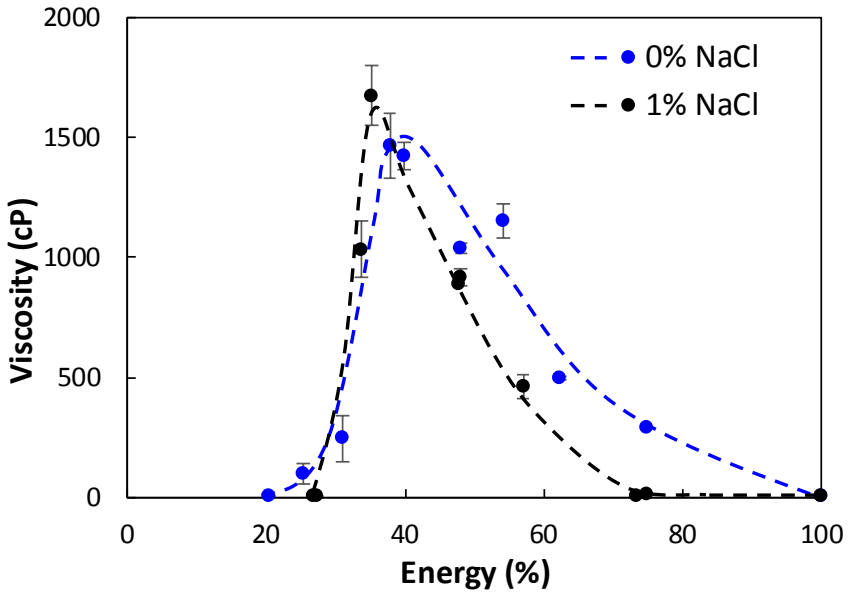

Figure S2. Viscosity of starch gel samples as a function of energy (% of total energy in the respective system) at different temperatures during ramping in FlexiWAVE. The total energy for the ramping was estimated at 389 kJ in 0% NaCl and 353 kJ in 1% NaCl.