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Polyhydroxyalkanoates production by bacterial consortium from thermal hydrolyzed waste sludge

The treatment and disposal of sewage sludge from waste water treatment plant has always been a tough problem for its large amount of emission, serious environmental hazards, difficult processing technology and high economic cost. Thermal hydrolysis process (THP) heats the sludge at 160–180°C for 30–60 min during which particles are intensively scattered and hydrolysed, which is expected to aid subsequent acidogenic or methanogenic fermentation. Biomass fed by VFAs fermented from sludge acidification could generate high content polyhydroxyalkanoates (PHAs). Thus, the biodegradable plastic production from sewage sludge has the potential to alleviate plastic crisis and above problem. However, there was little research focus on the effect of THP on VFAs production in acidogenic fermentation and PHAs production from TH sludge acidified liquid was also rarely studied. The overall process of PHA production in a mixed culture fed by TH sludge acidified liquid with high-level soluble organics and nutrients (nitrogen and phosphorus) was investigated in this study. Thermal hydrolyzed sludge and raw sludge were compared on VFAs yields in acidogenic fermentation at 35°C and 55°C. Optimal VFAs yield was obtained from TH sludge at 35°C (0.22g VFACOD/gVS), 44.6% higher than raw sludge at 35°C, since the advantage of TH-sludge in SCOD solubilization overcame its disadvantage of lower carbon biodegradability. Moreover, high temperature (55°C) was proved to aid the acidification of raw sludge by 15.7% (in YVFAs), but inhibition that of TH sludge by 12.2%, mainly due to the suppressed microbial activities under heat. Microbial community analysis showed that TH sludge had a larger proportion of acidogenic microbes than raw sludge mainly attributing to the increase of Selenomonadales (37.3% vs., 3.7%); high temperature enriched thermophilic proteolytic microbes, *Anaerobaculum and Coprothermobacter*. Finally, optimal acidified liquid from TH sludge at 35°C was applied for PHAs production and achieved a competitive yield of 60% PHAs/DCW.

Biography

Hui Wang received her MS and PhD from Jinlin University, Chinese Academy of Science in 1997, respectively. She also conducted research in 2001-2002 as a Postdoc at Department of Biology, Massachussett Institute of Technology in US. After jointing in Tsinghua University, she has dedicated herself in R&D in two aspects like bioremediation of contaminated soil and polluted urban water environment; novel biological processes for PHAs production from waste carbon sources with emphasis of waste sludge. She was appointed as full professor in 2009 and became the Director of Dept. of Environmental Science, Tsinghua University in 2010. During the past decades, she has served as Leaders or Chair Professors in several national key research projects for urban water pollution control in China and has received many rewards from provincial governments and national government. She also successfully demonstrated an integrated novel biological process in a pilot scale PHA production system by using waste sewage sludge as sole raw materials in Luchun WWPT, China. She has published over 100 international peer reviewed papers and 15 issued patents, several patents of her have been licensed to several companies that succeeded in bioremediation of polluted unban water environment. She also serves as Editorial Board Members in some international peer review journals.

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