

**TITLE:** EVALUATION OF METHANE YIELD AND BACTERIA AND ARCHAEA COMMUNITIES FROM BREWERY SPENT GRAIN

**AUTHORS:** GOMES, M.M.; SAKAMOTO, I.K.; VARESECHE, M.B.A.

**INSTITUTION:** \* SÃO CARLOS SCHOOL OF ENGINEERING, UNIVERSITY OF SÃO PAULO, CAMPUS II (AVENIDA JOÃO DAGNONE, 1100, CEP 13563120, SÃO CARLOS-SP, BRAZIL)

**ABSTRACT:**

In this study, it was evaluated methane yield from brewery spent grain (BSG), the most abundant waste in brewery industry, used in three granulometry. Four essays were conducted using anaerobic batch reactors inoculated with granular sludge, with BSG: raw (R), ground (G) and milled (M). Besides, one control essay without BSG was performed (C). Bacterial and archaeal communities were analysed using polymerase chain reaction and denaturing gradient gel electrophoresis (PCR/DGGE). Bacteria population similarity between R and G and R and M was 68% and 41%, respectively. It was possible to infer that population structure was influenced by the BSG size particles, which were from 4.75 to 5.6 mm (R); 0.84 to 1.41 mm (G) and 0.59 to 0.84 mm (M). Carbohydrate removal efficiency of 53.3% (R), 81.4% (G) and 86.6% (M) reiterate that bacteria activity was distinct in the three conditions. The diversity indexes (Shannon-Wiener) in R (1.91), G (2.38) and M (2.20) showed higher bacterial diversity in G and M, probably, those populations were acting on hydrolysis, acidogenesis and acetogenesis. Concerning to population structure methanogenic archaea, it was observed similarity of 57% between IN and T and between IN and M. This suggests that different metabolization rates of complex carbohydrates to organic acids by bacteria population influenced the substrate availability for methane conversion by methanogenic archaea. Archaea diversity index was of 1.61 (R), 1.79 (G) and 2.00 (M). Therefore, it was verified archaea diversity increase when BSG particle size applied was smaller. Similar methane yield were observed (164.18; 175.76 and 171.58 mL.g<sup>-1</sup>SV for R, G and M, respectively). However, methane yield rate (R<sub>m</sub>) was higher for G and M (2.36 and 2.78 mLg<sup>-1</sup>SV.h<sup>-1</sup>, respectively) and the period for beginning methane detection (λ) was shorter in these essays (27.3 and 35.1 hours, respectively). In the essay R, R<sub>m</sub> was of 1.23 mLg<sup>-1</sup>STV.h<sup>-1</sup> and λ of 48 hours. Thus, particle size reduction of BSG was favored hydrolytic and fermentative activity of bacteria groups and, consequently, the methanogenic activity.

**Keywords:** Anaerobic digestion, brewery waste, microbial diversity, substrate particle size, PCR/DGGE.

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