RELEVANCE OF EUKARYOTE IN CO_2 EMISSION DURING WASTEWATER TREATMENT PROCESS

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Wastewater treatment plants are one of the important, dispersed sources of greenhouse gases – mainly carbon dioxide (CO_2) and methane (CH_4). These gases are produced with varied intensity at each stage and each device (mixing chambers, aerating zones, etc.) of the purification process. In literature are available many reports of CO_2 and CH_4 emissions from typical wastewater treatment plants (WWTP), yet, the number of data of emission in sequential WWTP, including sequencing batch reactors (SBR) is relatively small (IPCC 2014a,b).

In the SBR technology, all phases of biological wastewater treatment are take places in a single reactor in following steps. The issue of greenhouse gas (GHG) emissions from the SBRs seems important, as currently there is an evident return to this technology after a period of declining interest. The activated sludge is one of the process factors in the biological wastewater treatment process. It is a complex system matter, with bacteria (prokaryotes) and higher organisms (eukaryotes) as the most important elements. Each of these groups of organisms contributes to the wastewater treatment process and in the production of CO_2 (Gray 2004, Seviour and Nielsen 2010, Jaromin-Gleń et. al. 2013).

The aim of study was to determine the participation of eukaryotes, to the total amount of emitted CO_2, thus determining indirectly the contribution of bacteria (prokaryotes). Measurements were carry out in 3 laboratory systems for modelling the processes of the biological part of wastewater treatment plants, i.e. SBR-type reactors facilitating wastewater treatment and simultaneous measurements of e.g. gas emissions.

The reactors worked in a 12-h cycle (2 cycles per day). The emission of CO_2 was monitored in each subsequent season over a year.

Measuring CO_2 emissions and knowing abundance of eukaryotes in the sludge as well having from literature (Foissner i in. 1991; Foissner i in. 1992; Foissner i in. 1994; Foissner i in. 1995; Foissner and Berger 1996) the information about of emission attributable to one individual, it was possible to determine the contribution of higher organisms (eukaryotes) to the total CO_2 emissions.

Table 1. The share of eukaryotes in the total CO_2 emission.

Season	Share [ppm]
Summer	9.92
Autumn	3.32
Winter	1.44
Spring	2.86

With the assumption that emission is caused only by eukaryotes and prokaryotes, it was possible for the first time to quantify the contribution of prokaryotes and eukaryotes in the total CO_2 emission. As expected, the contribution of eukaryotes was very low, i.e. 0,0002–0,001%, compared with the 99,9998–99,999% contribution of prokaryotes (Jaromin-Gleń et. al. 2020).

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