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EFFECT OF REACTION OF OZONE AND ORGANIC POLLUTANTS ON THE EFFICACY OF WASTE WATER TREATMENT

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- paper in short presentation -

Ozone is a strong oxidant and a potent disinfecting agent. In the food industry, the ozone has two great potential application areas, the first is disinfections of surfaces, technological water or direct disinfections of foods, and the second is the wastewater treatment, lowering chemical and biological oxygen demand. The reaction of ozone with organic food components may strongly affect in both applications: it is essentially important to know, how ozone decrease the concentration of organic matter, e.g. the chemical or biological oxygen demand in planning of waste water treatment technologies.

The compounds with large molecular size may decompose to smaller size molecules. In consequence of ozone treatment, the organic matter became more available nutrient for micro organisms, which is a real risk in the disinfecting applications of ozone in the food industry, because the ozone treated surfaces, waters etc. became a good “culture medium” for micro organisms instead of disinfections.

At the same time, these decomposition reactions may be very useful, when the goal is the pre-treatment of non-biodegradable organic matter before the biological wastewater treatment.

The aim of this preliminary work was to investigate the biodegradability of organic matters treated ozone. The investigated model compounds were very common carbohydrates in food processing, the glucose and the water soluble and non-modified starch.

The ozone treatments were evaluated in continuously mixed starch solutions, the concentration of organic matter were 300 mg/l. Ozone was generated from oxygen, and bubbled through 250 ml of solution. The ozone concentration in the feed gas was 32 mg/l, the contact time was 20 min, the flow rate of bubbling gas was 1 l/min. Chemical oxygen demand (COD) were measured before and after ozone treatment according to the dichromate standard method. Biodegradability tests were evaluated by

measuring biological oxygen demand (BOD) of solutions, by respirometric method. The biodegradability of glucose (G), non-modified wheat starch (NMS), ozonated non modified wheat starch (NMSO), water soluble starch (WSS) and ozone treated water soluble starch (WSSO) were compared.
Biodegradability during 5 days ($BD_5\%$) was calculated by the expression

$$BD_5\% = (BOD_5/COD_0) \times 100$$

BOD can be expressed as a function of time as follows:

$$BOD = BOD_0(1 - e^{-kt})$$

where BOD_0 is the total amount of biodegradable matter and k is the biodegradation rate constant. The value of k was obtained by least squares analysis, applying the above equation to the experimental results.

The results given in Table I show that the ozone treatment cause degradation of water soluble starch, the COD decreased by approximately 40% duringafter 20 minutes treatment. At the same time, the COD was practically unchanged in case of in similar treatment procedure.

The results of biodegradability tests are assumed in Table 1.

Table 1. Biokinetic data of model solutions

Solution	k (1/d)	$BD_5\%$
G	0,70	0,97
NMS	0,26	0,73
NMSO	0,26	0,73
WSS	0,24	0,70
WSSO	0,60	0,95

The biodegradability was very similar in case of water soluble and non-modified starch. These results show that the ozone treatment had no significant effect on COD and biodegradability of non-modified wheat starch. The very same ozone treatment can reduce the COD level and improve biodegradability in water-soluble starch solution, similarly in case of the simplest carbohydrate, the glucose. This experience refers to the fact, that the products of the water-soluble starch degradation are a good nutrient to microorganisms. At the same time, the applied ozonation time was not enough to destroy the complex structure causing change in the biodegradability.

This preliminary results show that the ozonation is appropriate method for enhancing biodegradability, but in the case of very large and stable molecules a high ozone dose necessary to achieve any change.