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The Aerobic Biodegradation of UDMH Wastewater and Its Kinetics Research

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Unsymmetrical dimethylhydrazine (UDMH) is a main liquid rocket propellant. There are plenty of toxic and stable contaminations in its wastewater. The harmful influence has been considered. Nowadays the disposal technology of wastewater containing UDMH has plenty of disadvantages, such as high energy consuming, low safety factor, numerous secondary contaminations, strong toxicity, and so on. It is necessary to find a new way for wastewater disposal. Biodegradation technology is low innocuity and cleanliness, has great degradation capacity, and can almost degrade all kinds of organic substances. In this paper the aerobic active sludge is used to treat wastewater containing UDMH which is one kind of biodegradation technology.

The aerobic active sludge with big granule, good sedimentation, clearly effluent, rotifer under the microscope is acclimated for 60 days. The removing rate of COD_{cr} and UDMH is 89% and 98% respectively. During the acclimating process, COD_{cr}, DO, nitrite, UDMH should be measured. It is shown that DO is the most important factor which could influence the growth of bacteria, sludge character, effluent quality. So it is indispensable to keep the appropriate DO.

The value of pH, sludge concentration, temperature and milling velocity, UDMH concentration could influence biodegradation effect. When pH is 7.0 – 7.5, sludge concentration is 1.6 – 1.28 $g \cdot L^{-1}$, temperature is 25 – 30 ℃, milling velocity is 80 – 100 $r \cdot min^{-1}$, and UDMH concentration is less than 1580 $mg \cdot L^{-1}$, the degradation power is the best.

According to the kinetics analysis, the aerobic biodegradation approximates first order reaction. Hereby the macro dynamics equations of different concentration are got. Higher the concentration is, less the velocity constant is. Actually, when the concentration is low enough, the reaction progression actually is $0 < n < 1$, and when the concentration is high enough, the reaction progression is $n > 1$.

UDMH which has not been oxidated, FDMH (formaldehyde dimethylhydrazone), TMT (1,1,4,4-tetramethyl-2-tetrazene), DMA (dimethylamine), DMF (dimethyl formamide), acetaldehyde dimethylhydrazone, 1-methyl-1-H-1,2,4-triazole are found in the degradated wastewater by GC/MS analysis. The pretreatment method is SPME (Solid Phase Micro Extraction) before the analysis process. FDMH is a large proportion in all the compounds.

In a word, the method could effectively remove UDMH in liquid waste with the peaceable reaction and low cost, and it is an effective process for treatment of the UDMH wastewater.

Key words: unsymmetrical dimethylhydrazine; wastewater; aerobic biodegradation; dynamic

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