

CONDITION OPTIMIZATION AND ECONOMIC ANALYSE OF ULTRASONIC-ALKALI CRACKING OF EXCESS SLUDGE

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China's sewage treatment plants are generally insufficient carbon sources, often by adding external carbon sources (methanol, acetic acid, glucose, etc.) to solve(Tao et al., 2021), may bring about an increase in the output of excess sludge, and cost a lot of operating costs (Feng et al., 2015)。 Excess sludge hydrolysis is an important way to solve the shortage of carbon source for biological denitrification and phosphorus removal in wastewater treatment plants and to achieve sludge minimization.Reduce operating costs for sewage treatment plants. The main methods of sludge cracking are microwave treatment(Lin et al., 2020), ultrasound (Xu et al., 2019) and heat treatment (Wang et al., 2009), Acid/alkaline treatment (Li et al., 2017; Xie et al., 2014)et al. Among them, the ultrasonic-alkali combination method has certain advantages, ultrasonic waves can promote the release of cellular organic matter in a short period of time, alkalilil crack can promote the hydrolysis of organic matter (Gao et al., 2021), and the synergistic effect of the two is better than that used only.

Most of the existing studies have focused on the release of SCOD in the sludge, and have not noticed that the

return of N and P released at the same time may make C/N and C/P low, not conducive to nitrogen and phosphorus removal, and have not noticed economic cost analysis. Therefore, in this study, the changes of C/N and C/P are paid attention to at the same time as obtaining high carbon-containing supernatants, so as to avoid excessive nitrogen and phosphorus in the return carbon source. The orthogonal test optimizes the required ultrasound-alkaline crack conditions of high SCOD and high C/N and C/P, and compares this technique with other cracking techniques.

The following conditions were recommended: Power density = 1.5 W/ml, pH = 10, ultrasound time = 15 min, alkali time = 1.5 h, SCOD > 7 600 mg/L, C/N > 30, C/P > 60, which can prepare sludge supernatant with high carbon and low nitrogen and phosphorus, and save cost than the way of external carbon source. VSS removal rate reaches about 35%, which can reduce the sludge disposal VSS removal rate of about 35% can reduce the cost of sludge disposal. The economic cost is about 38.7 RMB/t sludge when the technology is applied on a large scale.

Table. 1 Results of different parameter combinations

Power density (W/ml)	pH	Ultrasound Time (min)	Alkali Time (h)	Crack rate (%)	C/N	C/P
1	10	15	1	2.9	80.16	55.19
2	11	25	1.5	3.5	59.97	54.67
3	12	35	2	9.5	38.11	56.32
4	10	25	2	3.0	58.83	70.86
5	11	35	1	2.8	44.33	51.03
6	12	15	1.5	12.8	34.80	61.36
7	10	35	1.5	5.0	31.18	60.46
8	11	15	2	4.9	23.85	46.08

Power density (W/ml)	pH	Ultrasound Time (min)	Alkali Time (h)	Crack rate (%)	C/N	C/P
9	2	12	25	1	13.1	34.23 60.42

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