Kombinasi proses koagulasi-flokulasi dan filtrasi membran untuk pengolahan limbah cair industri tahu = Combination of coagulation-flocculation and membrane filtration process for tofu industrial wastewater treatment

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Abstrak

Produksi tahu di Indonesia menghasilkan limbah cair membentuk emulsi dan lebih pekat dibanding limbah tempe karena adanya proses penggilingan kedelai menjadi bubur, bersifat asam akibat penambahan asam saat penggumpalan tahu, dan berbau. Limbah cair tahu dapat diuraikan oleh mikroorganisme air, namun hal ini akan mengakibatkan berkurangnya kadar oksigen terlarut dalam air dan menimbulkan dampak terhadap ekosistem dan lingkungan sehingga masih membutuhkan metode pengolahan yang lebih efektif.
Penelitian ini mengombinasikan ultrafiltrasi membran polisulfon dan osmosis balik dengan pretreatment berupa proses koagulasi-flokulasi dengan koagulan tawas. Proses koagulasi-flokulasi dilakukan dengan variasi dosis koagulan 100 ppm, 200 ppm, 300 ppm, 400 ppm, 500 ppm, 600 ppm, 700 ppm, dan 800 ppm, proses ultrafiltrasi dengan variasi tekanan umpan 0,5 bar, 1 bar, 1,5 bar, dan 2 bar, sedangkan osmosis balik dilakukan dengan variasi tekanan umpan 4 bar, 5 bar, dan 6 bar. Limbah cair tahu memiliki karakteristik pH 3-5, TSS 600-1200 mg/L, kekeruhan 800-1400 FAU, TDS 1200-1600 mg/L, COD 5000-8000 mg/L, dan BOD 4600 mg/L.
Hasil penelitian menunjukkan bahwa koagulasi-flokulasi yang optimal terjadi pada dosis tawas 300 ppm dengan hasil penyisihan TSS sebesar 82%, ultrafiltrasi optimal terjadi pada tekanan 0,5 bar dengan penyisihan TSS 93,6%, TDS 88%, kekeruhan 92,4%, dan COD 95,1%, serta osmosis balik optimal terjadi pada tekanan umpan dengan penyisihan TSS 100%, TDS 99%, kekeruhan 100%, dan COD 98,8%, di mana persentase penyisihan BOD total adalah 99,6%.
<hr /><i>Tofu industry in Indonesia produces wastewater as its byproduct, which forms emulsion and more concentrated than tempeh wastewater as a result of soybean grinding process to form solid soy pulp, morevover it has acidic properties for its coagulation process with acid coagulant. Tofu wastewater can be degraded by water microorganism with reducing dissolved oxygen level in water as a drawback, and eventually impacts the environment.
This study aims to process tofu wastewater by combining ultrafiltration by polysulfone membrane and reverse osmosis with coagulation-flocculation by aluminum sulfate as pretreatment. Coagulation-flocculation was conducted with coagulant dose of 100 ppm, 200 ppm, 300 ppm, 400 ppm, 500 ppm, 600 ppm, 700 ppm, and 800 ppm, while ultrafiltration was conducted with feed pressure variation of 0,5 bar, 1 bar, 1,5 bar, and 2 bars, and reverse osmosis was conducted with feed pressure variation of 4 bars, 5 bars, and 6 bars. Tofu wastewater feed has characteristics of pH value of 3-4, TSS 600-1200 mg/L, turbidity 800-1400 FAU, TDS 1200-1600 mg/L, COD 5000-8000 mg/L, and BOD 4600 mg/L.
Experimental result showed that optimum coagulation-flocculation occured at aluminum sulfate dose of 300 ppm with TSS rejection of 82%, optimum ultrafiltration occured at 0,5 bar feed pressure with rejection value of TSS 93,6%, TDS 88%, turbidity 92,4%, and COD 95,1%, as well as optimum reverse osmosis occured at 6 bars feed pressure with rejection value of TSS 100%, TDS 99%, turbidity 100%, and COD

98,8%, where overall BOD rejection was 99,6%.</i>