

Comparison of Three Metal Doped Titanium Dioxide Photo-Catalysts Performances for Treatment of Municipal Wastewater Under Simulated Solarlight

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This study aimed to assess performance of a solar slurry photocatalytic membrane reactor for municipal wastewater treatment, using three metal – doped TiO₂ catalysts (for photocatalytic step) and a polymer based membrane (for membrane separation step). The photocatalyst were synthesized via sol-gel method starting from titanium isopropoxide 97%, Fe(NO₃)₃·9H₂O 99.95% (as iron precursor), Co(NO₃)₂·6H₂O 99.999% (cobalt precursor), Ni(NO₃)₂·6H₂O 99.999% (nickel precursor) and ethanol as solvent [1]. The membrane was prepared by phase inversion technique using a 12% polysulfone solution [2]. Global indicators monitored in order to assess process efficiencies were COD and TSM.

Municipal wastewater samples was subjected to irradiation for 7 hours by simulated solar light (intensity within 35-47 W/m²). The photocatalyst concentration used was 200 mg/L. The treated water resulted after each photocatalytic step was subject to membrane separation (working pressure 2.5-3 bar). Photocatalytic degradation of organic compounds obeys the pseudo-first order kinetic (Fig. 1). The best results were recorded for 1%Fe-TiO₂ catalyst (residual COD = 17.6 mg O₂/L), while TSM were removed to a concentration under 5 mg/L for each catalyst (Tab. 1), similar with previous treatment experiments performed at laboratory level [3]. After 6 treatment cycles the membrane didn't shown any significant fouling effect (Fig. 2).

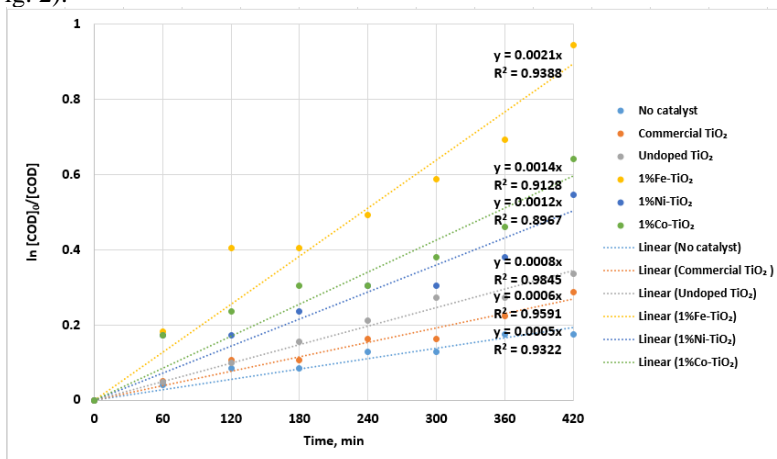


Fig. 1

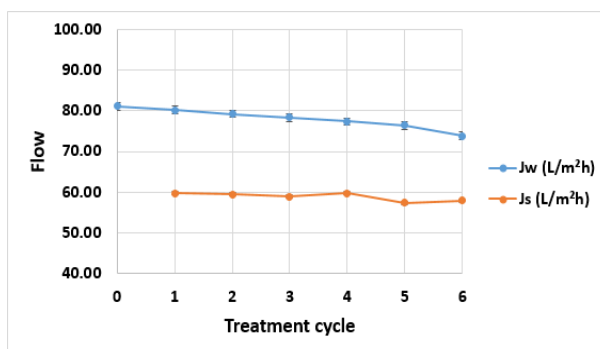


Fig. 2

Indicator		Without catalyst	Commercial TiO ₂	Synthesized TiO ₂	1% Fe-TiO ₂	1% Ni-TiO ₂	1% Co-TiO ₂
COD	Initial (mg O ₂ /L)	220	176	184.8	158.4	167.2	167.2
	PR (mg O ₂ /L)	184.8	132	132	61.6	96.8	88
	Efficiency PR (%)	16	25	28.57	61.11	42.11	47.37
	PMR (mg O ₂ /L)	167.2	96.8	96.8	17.6	61.6	79.2
	Efficiency PMR (%)	24	45	47.62	88.89	63.16	52.63
	Initial (mg/L)	42	47	50	51	47	37
TSM	Initial (mg/L)	42	47	50	51	47	37
	PMR (mg/L)	<5	<5	<5	<5	<5	<5

Tab. 1

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References:

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