Different Process Configurations for Biomass-Carrier-Based Treatment of Industrial Wastewater

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Introduction

Biological treatment is still the most cost effective method to oxidize organic pollutants in wastewater. However, industrial wastewaters from different sources vary widely in composition. In some cases, the wastewater composition might prevent biological treatment by itself to meet effluent requirements. This work presents several different case studies: in laboratory, pilot and full scale, for implementation of a biomass carrier based biological treatment process in combination with the suitable pretreatment and post-treatment processes. The Biomass carrier based biological treatment used is the AGAR® Process (Attached Growth Airlift Reactor).

Case 1: Aerobic Polishing of Anaerobic Reactor Effluent for Discharge to Sewer

In a food and beverage plant in Europe, with seasonal variations according to type of products, effluents from an existing anaerobic treatment system were not compliant with sewage discharge requirements. The plant required an additional average removal of 27% of the COD for the max daily capacity and COD load of 500 m^3/d and 315 kg/d, respectively.

An AGAR® biological reactor was commissioned in July 2004. Results collected since, as presented in figure 1, show higher removal efficiency than required, including seasonal changes in production.

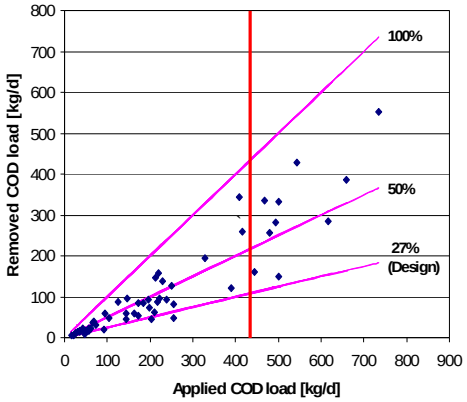

Figure 1: Annual Performance Analysis

Case 2: Roughing of Wastewater from a Pulp and Paper Plant

A RBC system in a paper mill in Italy could not handle the plant wastewater load of 2000 m^3/d, with a BOD5 of 400 mg/l and COD of about 800 mg/l, at a temperature of about 30°C. In order

to add the required treatment capacity, a roughing AGAR® biological reactor was designed to be added upstream of the RBC, with the intention to remove 60% of the BOD load.

The AGAR® reactor is designed as a single stage and 35% fill with ABC4 media, which has a protected surface area of 600 m^2/m^3. This allows for future expansion by increasing the fill ratio up to about 70%.

The retrofit was commissioned in July 2005. Due to the high water temperature, almost full development of the bio-film was noticed within less than a week.

	Wastewater		AGAR Effluent		Final Effluent	
	$BOD_{5,\ Tot}$	TSS	$BOD_{5,filt}$	TSS	$BOD_{5,\ Tot}$	TSS
Design	720	100	275	250	25	35
Results	375	38	35	160	13	11

Table 1: Full scale plant results compared with design data

Case 3: TOC Removal from Intermediates Plant Wastewater for Discharge to Evaporation Ponds

A small intermediates chemical plant in Israel was required to reduce effluent TOC levels to less than 100 mg/l for discharge to evaporation ponds. Wastewater is saline, highly variable in composition, and usually contains brominated organic compounds, aromatics and other. A laboratory study was performed, in order to establish a successful process flow diagram, as well as estimate treatment costs, prior to continuous piloting. The data presented in table 2 show the results for a three stage semi-batch treatment:

1 - Partial chemical oxidation will increase biodegradability and lower toxicity
2 - Biological treatment in an AGAR® reactor will remove most of the organic load
3 - Polishing by chemical oxidation will ensure low effluent TOC

mg/l	Wastewater	Partial chemical oxidation eff.	AGAR effluent	Polishing chem. oxidation eff.
TOC	13,500	11,500	< 3,000	< 50
COD	25,250	21,375	< 4,500	---
BOD	12,120	9,075		

Table 2: Case 3 lab process development results

Conclusions

In many cases, biological treatment of complex wastewater can be achieved as successfully as for the most straightforward applications, provided a suitable process scheme is developed. In that context, the AGAR® biomass carrier technology was found successful and cost-effective in biological treatment of complex industrial wastewater.