**FUNGI IN WASTEWATERS: SANITARY IMPLICATIONS AND POTENTIAL BIOREMEDIATION**

# FUNGI IN WASTEWATERS: SANITARY IMPLICATIONS AND POTENTIAL BIOREMEDIATION

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Activated sludge is the core of wastewater treatment plants (WWTP). Bacteria and their role have been deeply studied in order to improve the biodegradation of recalcitrant compounds (Herreroa et al., 2015). On the contrary, fungi remain still largely unexplored. Nevertheless, the knowledge of mycoflora in biological oxidation tank could give information on the wastewater overall impact, which includes ecological and health aspects, and functional features of a WWTP (Awad et al., 2011). Actually, the biotransformation of recalcitrant substances seems related to synergic activities of bacteria and fungi (Spina et al., 2012).

The present work is focused on the study of the mycoflora of 5 samples from oxidation tanks of 3 WWTP that treat tannery wastewaters (samples 1, 2, and 3), municipal wastewaters (sample 4), and landfill leachates (sample 5). The samples were inoculated on 3 different selective media (Diluted MEA, DRBC, Agar-Wastewater) and incubated at 15 and 25 °C to mimic the seasonal variations in the tanks. The main goals were the isolation of fungal strains for bioremediation applications and the evaluation of sanitary implications (presence of potentially human pathogens and toxinogenics species).

The main chemical parameters of the samples are reported in Table 1.

**Table 1.** Chemical characterisation

| Parameter | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|---|
| pH | 7.66 | 7.22 | 7.33 | 7.48 | 8.48 |
| Ammonium | 1.04 | 9.65 | 5.78 | 0.65 | 0.05 |
| Phosphate | 5.92 | 3.46 | 2.43 | 3.85 | 30.57 |
| Chlorides | 2906.90 | 4218.55 | 11.20 | 389.95 | - |
| SCOD | 14280.00 | 10000.00 | 14740.00 | 5520.00 | 1603.00 |
| TSS | 362.00 | 518.00 | 460.00 | 114.00 | - |
| VSS | 1293.33 | 749.33 | 576.67 | 687.33 | 3.10 |
| Total nitrogen | 1078,00 | 1261,33 | 960,67 | 486.00 | - |

All the samples had a high fungal load, up to 60000 CFU/100 mL in the case of municipal wastewater. Both the cultural medium and the temperature significantly affected the fungal load. Generally, DRBC and 25 °C allowed the highest recovery of fungi (Figure 1).

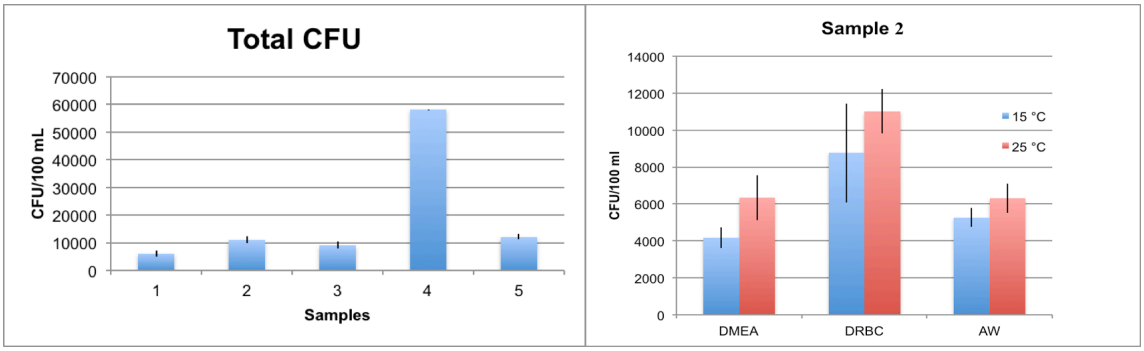


**Figure 1.** Maximal fungal load (CFU/100 mL) recovered in the 5 wastewater samples and an example (sample 2) of the influence of the media and temperatures on the fungal load.

From the five wastewaters, a total of 201 taxa, ascribable to 62 genera, were identified. About 1/3 of the species were exclusive of a specific wastewater. Nine species were common to all samples and 67 species were signaled for the first time from wastewaters. Agar-Wastewater (AW), the medium specifically designed to mimic WWTP conditions, allowed the development of the highest biodiversity from each sample. A total of 27 strains isolated from AW were selected for the bioremediation experiments according to high load on AW at both temperatures and to literature data.

In all samples, but mainly in landfill leachate, several potential human pathogens (risk class H2) were isolated (i.e. *Aspergillus fumigatus, Scedosporium prolificans, Pseudallescheria boidii, Trichophyton tonsurans,* and *Candida tropicalis*). These species may represent a danger for workers and population adjacent to WWTP on account of bioaerosol dispersion from oxidation tanks (Korzeniewska, 2011). Noteworthy is the presence of many potentially toxinogenic genera, such as *Aspergillus*, *Penicillium, Stachybotrys*, *Chaetomium* and *Fusarium*. These data raise the question on the use of activated sludge and wastewater in agriculture that would lead to introduce these organisms in the food chain with damage to food, animal husbandry, and human health.

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