



Wastewater treatment chemicals and organic chemistry alternatives for abattoir effluent

Project Description

The purpose of this project was to carry out a literature review of the most suitable chemicals for treating abattoir wastewater. The chemicals are categorized based on their cost, efficiency, and their overall environmental impact.

Chemical Treatment Methods

The most common chemicals used to treat abattoir waste water are coagulants and/or flocculants which are widely used for the removal of total solids (TS) and colloids. The degree of removal of organic matter by coagulation varies widely-between 30% and 90% depending on the characteristic of the wastewater. Table 1 presents some chemical coagulants and their efficiency in removing chemical oxygen demand (COD), biological oxygen demand (BOD) and total suspended solids (TSS) from abattoir wastewater.

Table 1: Removal efficiency of COD, BOD₅ and TSS using different coagulants.

COAGULANT	COD REMOVAL EFFICIENCY (%)	BOD REMOVAL EFFICIENCY (%)	TSS REMOVAL EFFICIENCY (%)
Al ₂ (SO ₄) ₃	33 - 87	30 - 88	31 - 97
Fe ₂ (SO ₄) ₃	64 - 78	81 - 91	43 - 98
PAX-18	69 - 80	45 - 79	57 - 97
Al ₂ (SO ₄) ₃ +AP	46 - 87	62 - 90	86 - 97
Fe ₂ (SO ₄) ₃ +AP	59 - 90	62 - 93	81 - 98
PAX-18+AP	69 - 80	79 - 90	88 - 98
Al ₂ (SO ₄) ₃ +AP+PE	79	86	85

AP: anionic polyacrylamide. PE: polyelectrolyte

Novel Chemical Treatments

The literature review revealed that a combination of ferric chloride and chitosan can be used efficiently in treatment of red meat processing wastewater. The optimum ratio of the two coagulants was found to be 16:1 and the removal efficiencies of COD, turbidity, and suspended solids (SS), being 53.7%, 93.7%, and 92.1%, respectively. This combination has shown positive impact on treatment systems comprising biological treatment and biogas generation, which is important for sites that operate anaerobic digestion processes with biogas recovery.

Economic Analysis

The cost of treating a cubic metre of wastewater with Alum, Ferric Sulfate, Ferric Sulphate plus AP, and Ferric Chloride plus Chitoson was found to be around 0.1, 0.2, 0.4, and 0.055 AUD/m³ respectively.

Hypothetical Example

The amount of coagulant required and the associated cost for an abattoir operating for 260 days per annum and producing 2,800 m³/day of wastewater, is shown in Table 2. The total cost of using this combination (ferric chloride and chitosan) in the wastewater treatment plant is approximately \$0.055/m³. This is half the cost of using alum which is around \$0.11 with similar removal efficiency.

Table 2: Amount of chemicals required and cost.

CHEMICALS	DOSE, mg/L	DOSE, kg/m ³	COST, AUD/ t	COST, AUD/m ³
Ferric chloride	160	0.16	250	0.04
Chitosan	10	0.01	1500	0.015
Total				0.055

The amount of sludge produced in this case is around 123 tonnes/year, as shown in Table 3. In case of alum, the amount of sludge produced is around 546 tonnes/year, meaning a sludge reduction of 77.5%. These are interesting results, however further research is required to confirm these findings and optimize the treatment process.

Table 3: Cost analysis per annum and sludge amount.

CHEMICALS	T /YEAR	COST, AUD/ YEAR	SLUDGE, t / YEAR
Ferric chloride	116	29,120	116
Chitosan	7.3	10,920	7.3
Total	123.3	40,040	123.3

Further Information

A copy of the final project report is obtainable from AMPC via email (info@ampc.com.au) or the Reports Library on the AMPC website (www.ampc.com.au/reports). Search for project code 2014.1044.