

DEDICATION

To my parents

To my wife

To my brother and sisters

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Principally, Praise to Allah (almighty), who has helped me to accomplish this work. First of all, I would like to thank my supervisor Dr. Elmugdad Ahmed Ali for his time, support and supervision throughout the thesis. I also want to give thanks to my co-supervisor Dr. Mohamed Elmukhtar for supporting me in the process of planning, and for his valuable advices.

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ABSTRACT

Vinasse which is a by-products of ethanol production is considered to be a serious hazards to the environment. Two sample (1 and 2) of vinasse, colored dark brown, were collected and detected to be acidic. Sample 1 and 2 were analyzed and gave 68.98 and 65.00 mg/dm³ biochemical oxygen demand (BOD), 125.77 and 200.00 mg/dm³ chemical oxygen demand (COD) and 489.6 and 480.4 mg/dm³ total organic carbon (TOC), respectively. GC-MS analysis detected the presence of phenols and carboxylic acids which also has negative effect on the environment. The detection of considerable amounts of potassium and sodium implied that vinasse could be used as a fertilizing.

The removal efficiency of TOC, color and aromatic organic compounds (AOC) from vinasse was examined using coagulation-flocculation techniques. Ferric chloride was used as a coagulant. In coagulation-flocculation techniques the effects of doses and pH values on TOC, color and AOC removal were studied. The efficiency of coagulation-flocculation in removing TOC gave 65.4 % when using 10g/dm³ of Ferric chloride and near to 100% in removing of color and AOC. The acidic condition was preferred for removing TOC, AOC and color from vinasse.

Persulfate (PS) and peroxymonosulfate (PMS) based advanced oxidation process (AOPs) were used as second stage to enhance the TOC removal. The effects of oxidant doses, oxidant to catalyst ratios, pH values and reaction times were studied. 69.9% and 48.6% of TOC were removed under optimum conditions of PMS and PS respectively. Overall removal of TOC from vinasse using coagulation-flocculation followed by PMS achieved 91.6% and 85.6% when using coagulation-flocculation followed by PS. Sulfate radical (SR)-AOP, however could be used as anew, promising and alternative technique for vinasse treatment.

المستخلص

يعتبر الفيناس (المنتج الثانوي من انتاج الايثانول) من المهددات الحقيقية للبيئة . تم تحليل عينتان من الفيناس 1 و 2 (ذات اللون البني الغامق والطبيعة الحمضية) وكانت نتائج العينتان كالاتي: كمية الاكسجين البيولوجي المطلوب (BOD) هي 68.98 و65.00 ملجم/دسم³ والاكسجين الكيميائي المطلوب (COD) 125.77 و20.000 ملجم/دسم³ و الكربون العضوي الكلي (TOC) 489.6 و480.4 ملجم/دسم³ علي التوالي. اوضحت التحاليل بجهاز الغاز كروموتوغرافي- مطياف الكتلة علي وجود الفينولات والاحماض الكربوكسيلية في الفيناس والتي تعتبر ذات اثار سالبة علي البيئة . هذه النتائج تدلل علي ان الفيناس ذات اثر سالب علي البيئة. تم تحديد كميات مقدره من البوتاسيوم والصوديوم في الفيناس حيث يمكن استخدامه كسماد.

تمت دراسة فعالية ازالة كل من الكربون العضوي الكلي واللون والمركبات الاروماتية العضوية من الفيناس باستخدام تقنية التبلد-التخثر. كلوريد الحديدك استخدم كمخثر، تم دراسة تاثير كل من الجرعات ودرجة الحموضة علي ازالة الكربون العضوي الكلي واللون والمركبات الاروماتية العضوية . عند استخدام تقنية التبلد-التخثر.تمت ازالة 65.4 % من الكربون العضوي الكلي ومايقارب 100% من اللون و المركبات اللاروماتية العضوية عند استخدام 10 ملجم/دسم³ من كلوريد الحديدك عند الحالة الحامضية.

تم استخدام كل من البيرسلفات والبيروكسي مونوسلفات المبنية علي عملية الاكسده المتقدمة لمعالجة الفيناس كمرحلة ثانية بعد عملية التبلد- التخثر لتحسين ازالة الكربون الكلي العضوي .تمت دراسة اثر كل من جرعات المؤكسدات ونسبة المؤكسدات الي المحفز ودرجة الحموضة والزمن. 69.9% و 48.6% من الكربون العضوي الكلي تمت ازالتها باستخدام البيروكسي مونوسلفات والبيرسلفات علي التوالي عند الظروف المثلي. الازالة الكلية للكربون الكلي العضوي باستخدام تقنية التبلد-التخثر متبوعة بنظام البيروكسي مونوسلفات حققت 91.6% و 85.6% عند استخدام تقنية التبلد-التخثر متبوعة بنظام البيرسلفات. تعتبر تقنية شقوق الكبريتات المبنية علي عملية الاكسده المتقدمة طريقة بديلة وواحدة لمعالجة الفيناس.

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LIST OF ABBREVIATIONS

AAS	Atomic absorption spectroscopy
AOC	Aromatic organic compounds
AOPs	Advanced oxidation processes
BOD	Biological oxygen demand
COD	Chemical oxygen demand
DCM	Dichloromethane
EI	Electron impact
EC	Electrical conductivity
ELM	Emulsion liquid membrane
GC-MS	Gas chromatography mass spectrometer
IR	Infrared
MAP	Magnesium ammonium phosphate
NF	Nano filtration
PS	Persulfate
PMS	Peroxymonosulfate
RT	Retention time
RO	Reverse osmosis
SR-AOP	Sulfate radical based advanced oxidation processes
SAR	Sodium absorption ratio

SSP	Soluble sodium percentage
TFC	Thin film composite
TFC	Thin film composite
TS	Total solids
TDS	Total dissolved solids
TSS	Total suspended solids
TIC	Total ion chromatogram
TOC	Total organic carbon
TIC	Total inorganic carbon
TC	Total carbon
TN	Total nitrogen
UASB	Upflow anaerobic sludge blanket
US	Ultrasound
UV	Ultra violet