ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Evaluate the efficiency of the two of species yeast *Candida dubliniensis* and *Candida glabrata* in reducing pollutants from wastewater using the batch system

Hussein Ali Sabtie, Inaam Noori Ali, Noor Nihad Baqer
Ministry of Science and Technology/ Environmental and Water Office/ Center of Water Researches and Laboratories

Manuscript Info

Manuscript History:

Received: 15 July 2014
Final Accepted: 26 August 2014
Published Online: September 2014

Key words:

Corresponding Author

Hussein Ali Sabtie

Abstract

Technique Vitek2 Compact was used to diagnosis two species of yeast *Candida dubliniensis* and *Candida glabrata* and utilized in the wastewater treatment through their efficiency in reducing some factor environment such as: COD, BOD_5, Total nitrate and phosphate in addition to DO and pH .These factors measured before and after treatment, the yeast grown on the plant basic material (peel potatoes) using batch culture. The efficiency of biological treatment by the two species of yeasts were measured. Positive results were recorded in reducing of environmental factors rates which as showed *C. dubliniensis* removal ratio of total phosphate and nitrate ,COD ,BOD_5 were 40% ,58.6% , 57.3%, 59.8% respectively, as well as change in the concentration of DO and pH as positive factors in the treatment, while showed *C.glabrata* removal rates of the factors were 60% , 62.4%, 66.2% and 79.9% respectively with change the concentrations of DO and pH and the treatment period for seven days, and through results showed *C. glabrata* more efficient than *C. dubliniensis* in removing the environmental factors.

Introduction

In the recent years, different natural and industrial pollutants were increased due to lack of regulatory control on it thus, a poor water quality. Wastewater contains large quantity of organic pollutants, causing adverse effects on human health and surrounding environment (Shivaraju, 2011). Large quantity of phosphorus and nitrogen in wastewater when discharge to aquatic environment causes several problems such as oxygen depletion and Eutrophication (Asamudo *et al*.,2005 ; Luostarinen *et al*.,2006), so it is necessary to removal of these pollutants from wastewater before discharged to aquatic environment and reduce their effects (Wang *et al*.,2006).

Study of (Jin *et al*.,1999; Van Leeuwen *et al*.,2003) showed the possibility of microorganisms such as fungi and yeast to produce a wide range of enzymes and biochemical materials and be more effective than the bacteria in metabolism of complex carbohydrate such as starch, wastewater treatment and the production of microbial biomass protein (MBP) (Jin *et al*.,1998, Zheng *et al*.,2005). Utilization of yeasts in wastewater treatment attracted the attention of many researchers because of the ease of culturing on acidified media and its rapid growth (Bergmann *et al*., 1988: Gonzalez et al.,1992) . Many researchers were used microorganisms in wastewater treatment (Woertz et al.,2001)showed the efficiency of yeast *Exophiala lecanii-cornii* in degradation and removal of toluene at percent of 95 % . Different genus of yeast were isolated from soil contaminated with petroleum hydrocarbons such as *candida, Yarrowia* and *Pichia* in degradation of hydrocarbones (Chaillan *et al.*,2004).

This study aim to evaluate the efficiency two species of yeast *Candida dubliniensis* and *Candida glabrata* that isolated from locally sites to reduce the concentrations of organic and inorganic pollutants from sewage water.

Materials and Methods:

1 - Isolation and diagnosis of yeast:

Samples of contaminated waters were collected and grown on the Potato Dextrose Agar (PDA) , then isolated yeasts and diagnosed by device Vitek Compact 2 for rapid diagnostic and detection of microorganisms. After that, the isolates of yeast were grown and activated on PDA by Streaking method as shown in figure (1),under the controlled conditions controlled by the heat and pH, then prepare the specific solution for each yeast isolate(Kurtzman and Jack ,1998)

2 – Treatment of wastewater by yeast isolates :

Samples of sewage water were collected from wastewater treatment Al-Rustamiya plant, sterilized by autoclave in order to kill all microorganisms, and test the efficiency of two types of yeast C. *glabrata* and C. *dubliniensis* in improving the specifications of the sewage. Cleaned Peel potatoes were used and sterilized by ultraviolet UV for seven days in the cultivation of yeasts and left in the incubator at temperature of 26-28 c°. Sterile wastewater were distributed in bottles 500 mL at three groups , the first group included potatoes peel which were grown by *C. glabrata* and second group was comprise C. *dubliniensis* and the third set as the control group(peels alone without yeast) . three replicates were done for each group and using the batch system for this experiments (Figure 2).

Some chemical and physical properties were calculated and represented by the pH, biological oxygen demand, chemical oxygen demand, dissolved oxygen, total phosphate and total nitrate for wastewater samples before and after treatment, which included sterile and non-sterile wastewater and wastewater bio-treated by two types of yeasts (APHA, 2006)

Figure (1) shows the two yeasts diagnosed cultivated on PDA media.

Figure (2) shows the batch system used in sewage treatment

Results and discussion:

The result in table (1) showed the two types of yeast, C. glabrata and C. dubliniensis that diagnosis by the device vitek compact 2 and used in the wastewater treatment. Table (2) showed the efficiency of type C. *dubliniensis* in reducing the rates of organic and inorganic pollutants in wastewater through 7 days from treatment, the removal rates of total phosphate and nitrates, BOD_5 and COD were recorded 40 % , 58.6 % ,57.3 % and 59.8 % respectively, as well as a change in the concentration of dissolved oxygen from 8.5 to 6.5 and pH from 9.0 to 5.3 , while the removal rates of environmental factors by using type *C. glabrata* 60%, 62.4%, 66.2%and 79.9 % respectively, with a change in the concentration of dissolved oxygen from 8.5 to 6.3 and pH 9.0 to 5.2 through the period of seven days of treatment (Table 3) .

This result was agreed with the result of Rabah et al.(2011) that used yeast biofilter of *Candida krusei*,*Candida morbosa, Torulopsis dattila, Torulopsis glabrata,* and *Saccharomyces chevalieri* in the bioremediate of abattoir wastewater. It was observed that there was a considerable reduction in BOD, COD, DO , pH, nitrate and phosphate after the biotreatment of the wastewater with the desired yeast, with the total percent of reduction by biotreatment 42.5% .

Result of Razif et al.(2006) showed that the removal rate of BOD was 70 % through the period of 14-day treatment of waste water discharged from factories preparation or sweet industry (cosmetics starchy) when using the yeast *Candida utilis*.

Table (1)shows the diagnosis of pure isolates using a equipment Vitek Compact2.

Slot	Card Type	Bar Code	Organism
1	YST	2432144401242656	*C. dubliniensis*
2	YST	2432144401242657	Slashline
3	YST	2432144401242658	Low Discrim
4	YST	2432144401242659	Unidentified
5	YST	2432144401242649	*C. glabrata*

Table(2)shows the efficiency of treatment using the yeast C. *dubliniensis* in wastewater treatment through the period of seven days in anaerobic conditions.

Parameters	Before treatment	After treatment	Reduction rate (%)
pH mg/L	9.0	5.3	-
DO mg/L	8.5	6.5	23.5
COD mg/L	1006	430	57.3
BOD_5 mg/L	1000	402	59.8
T.P mg/L	2.5	1.5	40
T.N mg/L	2.9	1.2	58.6

Table 3 shows the efficiency of treatment using the yeast *C. glabrata* in sewage treatment through the period of seven days in anaerobic conditions

Parameters	Before treatment	After treatment	Reduction rate (%)
pH mg/L	9.0	5.2	-
DO mg/L	8.5	6.3	25.9
COD mg/L	1006	340	66.2
BOD_5 mg/L	1000	201	79.9
T.P mg/L	2.5	1.0	60
T.N mg/L	2.9	1.09	62.4

Study of Öztepe and Özyurt(2011) appeared a reduction in the incidence rate of COD at (86-92 %) during the treatment period of 21 days in the treatment of sewage water discharged from the olive industry using the fungus *Aspergillus oryzae*.

The biological treatment of wastewater with the fungus *Coriolus versicolor* caused a reduction in COD of 53% during the period of treatment 8 days with the addition of peptone and glucose as a nutrient matter (Chopra et al.,2004). The advantage of being a fast-growing yeasts and be less sensitive to contamination with other microorganisms, and produce bio mass in the presence of high nutrients (Friedrich,2004)

The removal rate of phosphate from industrial wastewater by *Pseudomonas* at 68% and a reduction in pH was from 6-7 with presence of glucose as a source Carbon because it stimulates the removal of phosphate through the oxidative processes (Jeon, and Park,2000). The addition of external carbon source (peel potatoes) is essential for the growth and proliferation of microorganisms on the one hand and in the reduction of the environmental factors

present in the sewage on the other hand. The researcher (Tam *et al*., 1994) showed that the outer carbon-source gives a high removal percent rate of nitrate. De-Li *et al*., (2006) explained the efficiency combination of microorganisms (bacteria and fungi) in the removal of a number of contaminants from wastewater as the use of a combination of *Fusarium oxysporum* and *Pseudomonas stutzeri* cause the removal rate of nitrogen 87% during the period of treatment 6 days as it is there are many fungi and yeasts have the ability to remove nitrates. The fungi are one of efficient microoganisms in the biological treatment of sewage and industrial water due to their production of chemical matter such as amylase, chitin, chitosan, glucosamine, antimicrobials, lactic acids and contain extracellular enzymes for analysis of Pheonolic materials, pigments and hydrocarbons by oxidation reactions (D'Annibale *et al*., 2004).The decline in the proportion of nitrates at the lack of oxygen due to the activity and efficiency of microorganisms on nitrate reduction process of denitrification (anaerobic conditions) and the transfer of all forms of the nitrogen to nitrogen gas with the use of outer organic carbon in the nitrate reduction (Jaouani *et al*.,2005)

References:

(Ed.) , Fungal Biotechnology in Agricultural, Food and Environmental

APHA.(2005).Standard method for the examination of water and waste water 21st ed. American Puplic Heath Association , Washington ,DC.

Applications. Marcel Dekker Inc., New York, pp. 431–442.

Asamudo , N.U; Daba, A.S and Ezeronye, O.U. (2005). Bioremediation of textile dye effluents using *Phanerochaete chrysosporium*. Afr. J. Biotechnol.4(13): 1548-1553.

Bergmann, F.W; Abe, J and Hizukuri, S. (1988) Selection of microorganisms which produce raw-starch degrading enzymes. Appl Microbiol. Biotechnol. 27:443–446

Chaillan, F; Le Fl`eche,A; Bury,E.(2004) .Identification and biodegradation potential of tropical aerobic hydrocarbon degrading microorganisms. Res. in Microbiol.155(7): 587–595.

Chopra, P., Singh, D., Verma, V., Puniya, A.K., (2004). Bioremediation of melanoidin containing digested spent wash from cane-molasses distillery with white rot fungus Coriolus versicolor. Indian J. of Microbiol. 44 (3), 197–200.

D'Annibale ,A.; Ricci, M.; Quaratino ,D.; Federici ,F. and Fenice, M. (2004) Panus tigrinus efficiently removes phenols, color and organic load from olive-mill wastewater. Res Microbiol 155: 596–603.

De-Li, L ;Yong Liang ,Z.; Ping,L. , Naoki,T and Hirofumi,S.(2006) Biological nitrogen removal from waste water by Denitrification of mix- culturing fungi and bacteria . Acta. Hydrobiologica .Sinica. 30:(6):671-675.

Friedrich, J., 2004. Bioconversion of distillery waste. In:Arora, D.K.

Gonzalez, M.P; Siso, M.I.G.; Murado, M.A.; Pastrana, L.; Montemayor, M.I. and Miron, J. (1992).Depuration and valuation of mussel-processing wastes. Characterization of amylolytic post incubates from different species grown on an effluent. Bioresour .Technol 42:133–140

Jaouani, A.; Guillén ,F.; Penninckx, M.J; Martínez, A.T. and Martínez, M.J. (2005) Role of Pycnoporus coccineus laccase in the degradation of aromatic compounds in olive oil mill wastewater. Enzym. Microb. Technol. 36:478–486.

Jeon, C.O. and Park, J.M. (2000). Enhanced phosphorus removal in a sequencing batch reactor fed with glucose as a sole carbon source. Water Res., 34:2160-2170.

Jin ,B.; Van Leeuwen, J. and Patel, B. Y. Q. (1998) Utilization of starch processing wastewater for production of microbial biomass protein and fungal a-amylase by *Aspergillus oryzae*. Bioresour Technol 66:201–20

Jin ,B; Van Leeuwen, J.; Patel, B.; Doelle, H.W.; andYu, Q. (1999) Production of fungal protein and glucoamylase by *Rhizopus oligosporus* from starch processing wastewater. Process Biochem. 34:59–65

Kurtzman,C.P. and Jack, W.F. (1998).The yeast ;Ataxonomic study 4 th edition .Copyright by Elsevier Science B.V, Amsterdam Netherland. 77.

Luostarinen, S.; Luste, S.; Valentin, L. and Rintala, J. (2006). Nitrogen removal from on-site treated anaerobic effluents using intermittently aerated moving bed biofilm reactors at low temperatures.Water Res. 40: 1607-1615.

Öztepe, C. and Özyurt ,M.(2011). Biological degradation of olive black water by *Aspergillus oryzae* : A Pilot Plant Investigation Canadian. J. Environ.,Construction and Civil Engineering .2(3): 24-31.

Rabah ,A.B.; Ibrahim,M.L.; Ijah,U.J.J. and Manga,S.B.(2011).Assessment of the efficiency of a yeast biofilter in the treatment of abattoir wastewater Afr. J. of Biotechnol. :10(46), pp. 9347-9351.

Razif, M;Budiarti,V.E. and Mangkoedihardijo,S.(2006). Appropirate fermentation process for tapioca ' s waste water in indonesia . J. of Appl. Sci . 6(13):2846-2848.

Shivaraju, H.P. (2011) Removal of Organic Pollutants in the Municipal Sewage Water by Tio2 based Heterogeneous Photocatalysis I.J.E.S. 1(5):911-923.

Tam,N.F.Y.; Leung,G.L.W and Wong ,Y.S(1994).The effect of external Carbon loading on nitrogen removal in sequencing batch reactors. Water Sci Technol.30:(6):73-81.

Usharani, K and Lakshmanaperumalsamy, P(2010). Bio-treatment of phosphate from synthetic wastewater using *Pseudomonas* sp YLW-7. J. Appl. Sci. Environ. 14 (2): 75 - 80

Van Leeuwen ,J.; Hu, Z.; Yi, T.W.; Pometto, A.L and Jin, B. (2003) Kinetic model for selective cultivation of microfungi in a microscreen process for food processing wastewater treatment and biomass production. Acta. Biotechnol. 23:289–300

Wang ,X.J; Xia. S,Q; Chen. L.; Zhao ,J.F; Renault, N.J . and Chovelon, J.M.(2006). Nutrients removal from municipal wastewater by chemical precipitation in a moving bed biofilm reactor.Process Biochem. 41: 824-828.

Woertz, J.R; Kinney, K.A; McIntosh, N.D.P. and Szanisab, P.J. (2001). Removal of toluene in a Vapour phase bioreactor containing a strain of the dimorphic black yeast Exophiala lecarnii-cornii. Biotechnol. Bioeng. 75: 550-558.

Zheng ,S.; Yang, M.and Yang, Z .(2005). Biomass production of yeast isolate from salad oil manufacturing wastewater. Bioresour Technol 96:1183–1187