# ISOLATION AND CHARACTERIZATION OF HEAVY METAL CHELATOR MICROALGAE AND CONSTRUCTION OF PHOTOBIOREACTOR.

D. Jaizel Torres Salcedo, Alejandra Patiño Guerrero, Cesar Iñiguez; Universidad Autónoma de Baja California, Facultad de Ingeniería, Mexicali Baja California México; C.P. 21280; alejandra.patino@uabc.edu.mx

*Key words: Microalgae, Nitzschia palea, Photobioreactor*

**Introduction.** Industry emissions contaminate air, soil and water. Bioaccumulation of pollutants, especially heavy metals, represents a danger for the human being, as they are known to be the cause of multiple physiological disorders; therefore it has become a health and environmental problem that needs to be eradicated. This requires efficient and cost-effective technologies (1). Microalgae are tolerant to high concentrations of heavy metals, like cadmium (2). Some species also have the capability to act like bioindicators to heavy metals (3). Microalgae have mechanisms to keep the metal homeostasis and prevent intoxication (1). Studies demonstrate their efficiency to treat wastewaters contaminated with organic compounds (2). Biomass growth can be optimized in a photobioreactor that maximizes surface to volume ratio and regulates light intensity cycles.
The aim of this project is to isolate and characterize microalgae strains that have the ability to chelate heavy metals such as Pb, Cd, Hg, Ni, and the design of a photobioreactor that maximizes microalgae growth.

**Methods.** Samples of local (Mexicali, B.C.), stagnant were inoculated in ASPM medium with agar (2%) (4). Samples that showed greenish coloration were isolated in f/2 Guillard medium with agar (2%) (5). Wet mounts of the isolated strains were prepared for optical microscope analysis. All of the cultures were incubated at room temperature with white LED illumination for 24 hours.
A 3 gal cylindrical container (9.85"x13.0" D x H). made of acrylic was used.
An air pump employed for tank aeration was connected to a microcontroller PIC18F45K22 programmed in C language. An array of 24 white light emission diodes (LED) was developed. Light source was connected to the microcontroller, in order to regulate light intensity. A LM35 temperature sensor was connected to the same controlling system. The implemented timer allows setting up the time that the tank remains on. Control parameters are shown in a LCD display. The developed computer interphase allows charting and saving the temperature data. A 5 button user interphase was implemented in order to adjust the parameters of the biorreactor. Once finalized the process, all the data (temperature and information of the user and batch) recorded by the computer interphase are saved in a ".txt" extension file and showed in a chart.

**Results.** Wet mount technique was applied for microorganism characterization. Morphologic analysis of the isolated colonies showed that one of the isolated microorganisms have the same shape, color and subcellular structures that the ones reported for *Nitzschia palea* (**Fig. 1**). This is a diatom microalgae which has a lobulated or rounded plastid in each end. The valves are lanceolate with parallel sides and tapering rapidly at the poles, terminating whit subcapitate apices (6). *N. palea* has the characteristic of being tolerant to contaminants. *Nitzschia palea* is found in highly contaminated waters therefore they're call pollution-dependent (7). Results on heavy metal absorption capacity of this strain will be presented.

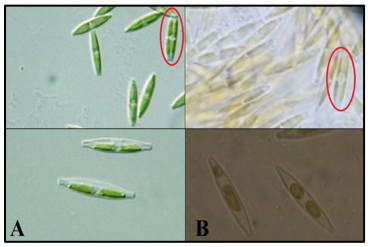


**Fig.1** (A) Microalgae *Nitzchia palea (6)*
(B) Isolated microorganism taken with optical microscope 100X.

**Conclusions.** A microorganism with matching morphologic characteristics to diatom microalgae *Nitzschia palea* was isolated from stagnant water under severe temperature conditions (around 50°C). Results suggest that this microorganism can be used to absorb heavy metals. Else, the high temperature survival indicate that a combined illumination regime (direct sunlight/LED) could be applied for continual growth. The controlled reactor system allows adjustment of light intensity, agitation and aeration, for biomass optimization purposes. Experiments regarding microorganism heavy metal absorption capacity are being performed.

**Acknowledgements.** Project supported by UABC's Bioengineering Lab. Growth media was provided by Dr. María del Pilar Sánchez Saavedra (CICESE).

**References.**

(1) Richmond, A., (2004). Absorption and Adsorption of Heavy Metals . In: *Microalgal culture, Biotechnology and Applied Phycology*. Blackwell Science Publishing, Australia. Pp 439-443.
(2) Doung T., Morin S., Herlory O., Feurtet-Mazel A., (2008). Seasonal effects of cadmium accumulation in periphytic diatom communities of fresh water biofilms. *Elsevier*. Aquatic Toxicology.
(3) Branco D., Lima A., et.al., (2010). Sensitivity of biochemical markers to evaluate cadmium stress in the freshwater diatom *Nitzschia palea*. *Elsevier*. Aquatic Toxicology.
(4) Medium composition. Retrieved 09-20-2012 from: http://www.nies.go.jp/chiiki1/protoz/toxicity/medium.htm
(5) F/2 medium. Retrieved 09-20-2012 from: http://www.nsm.buffalo.edu/Bio/burr/BURR%20Cultures/F2%20Mediapdf
(6) Kociolek P., (2011). *Nitzschia palea*. In: Diatoms of the United States. Retrieved 02-26-2013 from: http://westerndiatoms.colorado.edu/taxa/species/nitzschia_palea
(7) Wehr J., Sheath R., (2003). Keeled and canalled raphid diatoms In: *Freshwater Algae of North America Ecology and Classification*. Academic Press, Boston. Pp 672.