



## PHYSICOCHEMICAL CHARACTERIZATION AND TREATMENT OF DOMESTIC WASTEWATER USING BIO-DENITRIFICATION PROCESS

Y. Salama<sup>1,2</sup>, M. Mountadar<sup>2\*</sup>, M. Rihani<sup>1</sup>, O. Assobhei<sup>1</sup>

<sup>1</sup>Laboratory of Marine Biotechnology and Environment (BIOMARE), Faculty of Science, University Chouaib Doukkali, BP 20, 24000 El Jadida, Morocco

<sup>2</sup>Laboratory of Water and Environment, Faculty of Science, University Chouaib Doukkali, BP 20, 24000 El Jadida, Morocco  
mounta\_dar@yahoo.fr

### Abstract

The water consumption increases at high speed under the effect of the demographic growth and the agricultural and industrial development. This water consumption involves a significant and increasing quantity of wastewater. These untreated rejections generally are poured in receiving environment (lake, river, sea, etc.), causing harmful effects on the environment. In this study, the biological treatment of raw sewage from the sewer in El Jadida city (Morocco) had been tested in laboratory by using a bioreactor (immersed bacterial bed) colonized by a heterotrophic denitrifying flora.

The obtained results show that parameters of removal efficiency were 97.69, 96, 90, 82.11 and 89.30 % of nitrate (NO<sub>3</sub><sup>-</sup>-N), dissolved chemical oxygen demand (COD), biochemical oxygen demand (BOD<sub>5</sub>), total phosphorus (TP-P) and total Kjeldahl nitrogen (TKN-N) respectively when the system was operated at optimal conditions; pH 8.4, temperature of 28.9 °C and COD/NO<sub>3</sub><sup>-</sup>-N ratio equal to 5. Consequently, the treated effluent has respected the norms defined in Moroccan's project for all analyzed parameters.

**Keywords:** Domestic wastewater; pollution; biological treatment; anaerobic reactor; support media.

### 1. Introduction

Demographic, economic and urban increases are the cause of different environmental pollution sources (air pollution, surface and groundwater pollution, soil pollution ...), and especially in developing countries. Among these pollution sources, the production of untreated wastewater often released into the receiving environment (sea, rivers, soils...) causes physico-chemical and biological degradation environment which generate many hydric diseases [1-2-3-4].

Morocco is a country whose climate varies from sub-humid in the north, semi-arid to arid in center, and Saharian in the south, at which the demand of needed water for consumption and irrigation (especially in arid to semi-arid area) exceeds the resources. Moreover, it is highly dependent on irrigated agriculture. Morocco uses raw wastewater in irrigation as additional water resource. Furthermore, Morocco is a country poor in water resources, and in edge of penury. Water consumption has already reached the level which usually considered as water stress (1000 m<sup>3</sup>/habitant/year) [5]. In 2020, it is estimated that 35% of the population will be above the conditions of high stress level set at 500 m<sup>3</sup>/habitant/year [5]. There are about 35 treatments plants in the country, all of them seem partially or completely off-works. Consequently, the wastewater is discharged directly in rivers or in the sea and causing massive ecological

problems. Concerning reuse of treated wastewater, it is very weak due to the rundown infrastructure of treatment. In addition, Morocco has coastal and groundwater contaminated by irrigation water.

Our study aims to the biological treatment of domestic wastewater in a submerged bacterial bed with packed plastic. This kind of procedure has a large surface adhesion of purifying micro-organisms as well as the easy supply of the reactor [6-7]. The advantage of this method lies in its low cost compared to other treatment systems which require large amount of energy. After determining the physicochemical characteristics of the raw domestic effluent and performing its pretreatment by the passing through a settling tank, we evaluated the purification performance of the denitrifying biomass by measuring temperature, pH, NO<sub>3</sub><sup>-</sup>-N, NO<sub>2</sub><sup>-</sup>-N, COD, TKN-N and TP-P of the wastewater collected at the outlet of the bioreactor.

### 2. Material and methods

#### 2.1. Analytical methods

The origin of the poured residuary water in the sea comes from the domestic and industrial waters (95 and 5%). Samples of wastewater were collected from a domestic wastewater discharge channel of El Jadida city in Morocco and stored at 4 °C. The withdrawals were done on site. The analysis of different physical and chemical parameters (pH, temperature, MES, COD, BOD<sub>5</sub>,