SUMMARY

Microalgal culture offers an interesting step for wastewater treatments, because they provide a tertiary biotreatment coupled with the production of potenially valuable biomass, which can be used for several purposes. The purpose of this study was to investigate the possibility of using waste-isolated microalgae for wastewater treatment. This study began by isolating some microalgal species from El-Fayoum Wastewater Treatment Station (EWTS), then the isolated microalgae were subjected for identification. The identification studies leads to a total of four microalgal taxa related to Cyanophyta (three taxa), and Chlorophyta (one taxon). They were, *Stratonostoc linckia* f.*spongiaeforme ; Phormidium tenue; Microcystis aeruginosa* and *Chlorella vulgaris* , respectively.

Estimation of the algal growth, which has been grown on wastewater medium, was followed by determination of Chlorophyll (a) content and dry weight of the studied algae. The recorded data revealed the ability of these algae to grow on such crude wastewater. So, wastewater treatment process was carried out on those samples collected from El-Fayoum Wastewater, Treatment Station using the identified microalgae under three different conditions of treatment as follows:

A = Crude wastewater treated at incubating conditions (continuous light intensity of 4000 Lux at 27°C),

B = Pasteurized wastewater treated at incubating conditions (continuous light intensity of 4000 Lux at 27°C), and

C = Crude wastewater treated in batch system at room temperature and indirect sunlight.

This study magnificed the using of the identified four microalgal taxa in removing the loading amounts of wastewater nutrients (N & P); COD and BOD removal; coliforms as well as the treatment of some heavy metals such as Pb^{2+} , Hg^{2+} , Fe^{3+} , Zn^{2+} , Ni^{2+} and Cd^{2+} in addition to Mg^{2+} , Ca^{2+} , Na^{+} & K^{+} and some anions (HCO_3^- , Cl^- and SO_4^{2-}). Finally, the study also re-emphasize the importance of some physical factors such as temperature, light and pH which may affect the activity of two of the studied algae (both algae recorded the highest activity in the above part of study) in nutrient and heavy metal uptake. The results also revealed that, (C) condition was the most suitable conditions for wastewater treatment by all studied algae. Whereas, these algae exhibited their maximum efficiencies in the treatments of all investigated pollutants under the above-mentioned condition, but on relatively long time. On the other hand, the treatment under (B) conditions, in most cases, revealed the lowest activities for all the algae under study.

The four-studied microalgae revealed high efficiencies in removing wastewater NH_4^+- N (with 99 to 100% efficiency) and NO_3^-- N (with 89 to 100% efficiency). Only *Chlorella vulgaris* and

Microcystis aeruginosa recorded high efficiencies in removing wastewater NO_3^- - N (84 to 97%) than the other two algae.

The recorded data also claimed that, the highest removal efficiency of wastewater $PO_4^{3-} - P$ recorded by *Chlorella vulgaris* (99.9%) followed by *Microcystis aeruginosa* (94%). The other two microalgae, namely *Stratonostoc linckia* f.*spongiaeforme* and *Phormedium tenue* recorded an intermediate efficiency for $PO_4^{3-} - P$ removal (64 to 86%).

During the treatment under C and A conditions, both *Chlorella vulgaris* and *Microcystis aeruginosa* recorded the highest reduction percentage of wastewater COD (82 to 91%). However, at (B) conditions, both algae recorded an intermediate efficiencies as the same with *Stratonostoc linckia* f.*spongiaeforme* and *Phorrmidium tenue* at the three conditions A,B & C.

The results also indicated that, *Chlorella vulgaris* and *Microcystis aeruginosa* have higher efficiencies in reducing BOD with 85 to 89% efficiency. On the other hand both *Phormidium tenue* and *Stratonostoc linckia* f.*spongiaeforme* recorded an intermediate efficiencies in this respect. It worthmentioning that, after pasteurization of wastewater samples, the BOD reached zero content (0.0 mgL^{-1}) .

The four studied algae exhibited high activities against Coliforms, which reached sometimes, nil in wastewater samples during its treatment by the four studied algae.

The results also revealed the great abilities of the studied microalgae to accumulate six metal ions (Pb^{2+} , Hg^{2+} , Fe^{3+} , Zn^{2+} , Ni^{2+} and Cd^{2+}) from wastewater. In this respect, all the studied algae exhibited different potential capacities. Where *Chlorella vulgaris* followed by *Microcystis aeruginosa* were found to be the best two algae which can accumulate these metals with highly efficiency. It reach (97%) for Pb^{2+} ; (99%) for Hg^{2+} ; (95%) for Fe^{3+} ; (76%) for Zn^{2+} ; (99%) for Ni^{2+} and (76%) for Cd^{2+} by *Chlorella vulgaris* . While it reached (87%) for Pb^{2+}; (98%) for Hg^{2+}; (93%) for Fe^{3+} ; (69%) for Zn^{2+}; (97%) for Ni^{2+} and (74%) for Cd^{2+} by *Microcystis aeruginosa.*

The results also revealed the behaviour of the studied microalgae towards the treatment of some wastewater cations (Mg^{2+} , Ca^{2+} , Na^{+} & K^{+}) and anions (HCO_3^- , Cl^- and SO_4^{2-}). Recording data indicated that *Chlorella vulgaris* had the highest removal percentage of wastewater Mg^{2+} (92%) ; Ca^{2+} (100%) ; Na^{+} (100%) ; K^{+} (100%) ; Cl^- (90%) and SO_4^{2-} (95%). However, *Microcystis aeruginosa* recorded the highest removal efficiency of HCO_3^- (82%).

Chlorella vulgaris and *Microcystis aeruginosa* exhibited high efficiencies in removing the studied pollutants especially, $NO_2^- - N$, Pb^{2+}, Hg^{2+}, and Ni^{2+}. For this reason, a further work was conducted to investigate the effect of some physical factors on the activities of the two algae in uptaking the above mentioned four pollutants from culture media. The results indicated the importance of such conditions to improve the removal activities of those algae , as

under continuous light intensity of 4000 Lux at 24°C, *Chlorella vulgaris* recorded a high uptaking of the four investigated pollutants at slightly acidic pH (6.5). On the other hand, *Microcystis aeruginosa* exhibited much activity under continuous light intensity of 4000 Lux at 30°C and alkaline pH (8) .