

substances called lapachol. It is believed that these trichomes and their constituents of lapachol act as a reflective agent for the extreme sun rays incident on the leaves all over the day. The hypodermis of the lower surface has greater cells to compensate the loss of water through rapid transpiration that takes place from the upper surface of the leaves due to long-term exposure to sunshine. The mesophyll consists of multi-layers of palisade and spongy (storage) tissues of clear inter cellular spaces.

Pneumatophores (respiratory roots) play an important role for prosperity and survival of *Avicennia marina* plant in the particular combined conditions of warm, humid, salty and water-logged environment, where the cross section of the healthy root exhibits cork layer that interrupted by numerous lenticels at several spaces along the epidermis, through which (ventilating pores) respiration takes place. The cortex and the ground tissues are extensively aerenchymatous constituting the main bulk of the cross section of the root.

Owing to the petroleum oil pollution found on the north side of Abu-Minqar Island and its deteriorative effects on *Avicennia marina* plant, the peculiarities of the internal structure of leaf and pneumatophores exhibited several negative changes such as :

Firstly in leaf

- The layer of hairs or trichomes became dark and rusty in its appearance due to the deposition of fine ingredients of oil pollutants on the upper surface of the leaves.
- Compactness, darkness and decrement of the surface area of the epidermis, the hypodermis and the mesophyll tissue (palisade and storage cells). Moreover, the lower epidermis seemed covered by a thick layer of cutin.
- Appearance of scleride sheathes (cells with lignified walls) between cells of the mesophyll tissue.
- The salt glands on the lower epidermis of the leaf became superficially seated and smaller in size with much more compacted cells.

Secondly in Pneumatophores

- Increasing in the diameter of polluted pneumatophore may be due to the increment of phellogen tissue (cork cambium arising as secondary meristem activity giving rise to cork and phelloderm) as a result of pollution stress.
- Very fin ingredients of oil pollutants attacked, crushed and destroyed the epidermis and the cork tissues. Also, some tar and tannins were deposited in the ground tissue and also attacked the newly developing secondary roots (rootlets).
- The most outstanding feature was the appearance of malignant cells (destructive or destroyer cell) as a mass of small cells that finally developed into a tumor causing plant death.
- Appearance of dark insoluble substances between some ground cells and sometimes filling the intercellular spaces of all the ground tissue.
- Ultimately in the light of all the observations for the polluted plants, the present investigation concluded that the all injuries resulting from petroleum oil pollutants cause a great reduction in the vital physiological

processes and in the efficiency of all plant tissues leading to the destruction and hidden of the plants. Pathogenically, from the foregoing results, petroleum oil pollution causes distinct and serious diseases to *Avicennia marina* trees such as chlorosis and tuber culosis or parenchymatis. The more pollution by hydrocarbons on this plant in this area may lead to disappearance of vegetation.

6. Recommendation

On long run, because of the petroleum oil contamination and the anthropogenic activities in marine environments are considered as a weapons of massive destruction for mangrove and other marine ecosystems all over the world, so further studies must be done to find out scientific methodology for bioremediation of mangrove ecosystems as a landscaping and as an important nursery habitat for marine and terrestrial living organisms (animals, fish and birds).

The present study suggests using simple, save and cost effective strategy such as specific strains of bacteria capable to rapid get rid of oil pollutions through bio surfactant theory. We must give recommendations to oil tankers to avoid throwing any petroleum oil before entering Swize Canal

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