Arsenic Pollution And Its Detoxification Potential Of Marine Bacteria Isolated From Alang-Sosiya Ship Breaking Yard, India

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ABSTRACT

Coastal environments worldwide are threatened by the consequences of pollution, a risk particularly high in semienclosed basins just like the Mediterranean that's poorly studied from bioremediation potential perspective especially within the Southern coast. Here, we investigated the physical, chemical, and microbiological features of hydrocarbon and heavy metals contaminated sediments collected at El-Max bay (Egypt). Molecular and statistical approaches assessing the structure of the sediment-dwelling bacterial communities showed correlations between the composition of bacterial assemblages and therefore the associated environmental parameters. Fifty strains were isolated on mineral media supplemented by 1% petroleum and identified as a various range of hydrocarbon-degrading bacteria involved in several successional stages of biodegradation. We screened the gathering for biotechnological potential studying biosurfactant production, biofilm formation, and therefore the capability to utilize different hydrocarbons. Some strains were ready to grow on multiple hydrocarbons as unique carbon source and presented biosurfactant-like activities and/or capacity to make biofilm and owned genes involved in several detoxification/degradation processes. El-Max sediments represent a promising reservoir of novel bacterial strains adapted to high hydrocarbon contamination loads. The potential of the strains for exploitation for in place intervention to combat pollution in coastal areas is discussed.The Mediterranean is exposed to a high risk of pollution by petroleum hydrocarbons (HC), thanks to the presence of tens of web sites associated with their extraction, refinery, and transport along its coastline [1]. This risk is exacerbated by several factors, including the semienclosed nature of this sea and therefore the geographical location of most of the oil-producing and oil-consuming countries, placed, respectively, on the Southern and Northern sides of the basin, entailing the presence of pipeline terminal and oiler traffic. A recent analysis of the papers published within the last years about the microbiology of coastal and open-sea sites within the Mediterranean clearly showed that the Southern side of the basin has been largely neglected [2] although it hosts several polluted areas along its coasts, like El-Max district area (Alexandria, Egypt). thanks to the various industrial activities, the disposal of untreated waste effluents, and therefore the shipping activities, El-Max bay may be a coastal site chronically contaminated by petroleum and heavy metals [3] whose clean-up represents a challenge for the Egyptian country and for the whole research community. petroleum may be a mixture of organic compounds which will contain up to 20000 chemicals and it's hardly removable from polluted ecosystems by traditional methods [4]. Bioremediation is an alternate to physical and chemical methods and takes advantage of the aptitude of certain microbes to degrade HC, buffering the effect of oil pollution in natural ecosystems. Bioremediation are often achieved by adding nutrients to the autochthonous biodegrading microbes (biostimulation) or adding a microorganism’s inoculum within the polluted environment (bioaugmentation). The successfulness

of such approaches remains under debate [5–7]; however recent reports suggest the utilization of autochthonous bioaugmentation (ABA) because the best practice to revive polluted marine ecosystems [8]. The start line for such approach is that the detailed study of the range of microbial communities colonizing the polluted site of interest. Such survey should be accomplished through both molecular and cultivation dependent techniques that, respectively, allow (i) the correlation of the environmental parameters with the structure of the entire microbial communities and (ii) the enrichment, identification, and characterization of degrading microbes for traits of interest like th The aim of this study was to assess the arsenic contents at Alang-Sosiya, world's largest ship-breaking yard, India. Annually, many ships are dismantled, which cause discharge large amounts of detrimental and protracted pollutants at this location. ICP-OES analysis reveals that the typical arsenic contents at Alang-Sosiya were 20.01mg/kg and 18.75µg/L respectively in coastal sediment and seawater samples. The pollution index values of arsenic in coastal surface sediment from the sampler A1–A6 ranged between 2.95 to 4.23, indicating moderate to high level of arsenic pollution. The marine environment suffering from ship-scrapping activity and contaminated with arsenic is that the potential location to urge arsenic hypertolerant bacterial isolates. Out of 16 isolated bacterial strains, KKDK-1 and KKDK-2 sustained 600mM and 500mM arsenate respectively. The 16S rRNA ribotyping identified strains KKDK-1 and KKDK-2 as Halomonas species. The strain KKDK-1 showed the utmost arsenic accumulation of 21.7±3.3 mg g-1 cell dry weight at exponential phase (60h), followed by sudden extrusion of arsenic during stationary phase (84 h) of bacterial growth. Whereas, strain KKDK-2 accumulated 6.8±1.12 mg Arsenic g-1 cell dry weight during exponential phase (72 h), which remains almost invariable during stationary phase (96-144 h) of bacterial growth. TEM analysis revealed that the many amounts of intracellular electron dense particles accumulated in both KKDK-1 and KKDK-2 treated with arsenic. EDAX analysis confirmed the presence of heavy metal arsenic. These results indicate the hypertolerance of arsenic with higher accumulation capacity, signifying KKDK-1 and a couple of as potential candidates for arsenic detoxification of arsenic-contaminated sites. Biography Devang Bharatkumar Khambholja has completed his PhD in Biochemistry. After completion of his Masters in 2011, he was appointed as Research Fellow (JRF & SRF) in Ministry of Earth Sciences, Government of India sponsored project. He has published 3 papers in peer reviewed international journals and contributed a book chapter in Handbook of Arsenic Toxicology, Academic Press (Elsevier). Also he has presented and attended various National and International Conferences. Since 2017 he's working as an professor at BN Patel Institute of Paramedical and Science (Paramedical Division), Anand, Gujarat, India. Presently, he's performing on project entitled "Efficacy of Natural antibacterial agents incorporated onto guided tissue regeneration membrane against periodontal pathogens".