The exploitation of Microbes: Next Generation Global Solution

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Nature is a dynamic and complex system of continuous interactions among numerous biotic and abiotic components and the impacts of these interactions are sometimes perceived readily and sometimes at late (Dimkpa, Weinand, & Asch, 2009; Meier et al., 2010). A good number of discoveries and inventions in medicine, agriculture or industry once renowned as very useful, turned into non-disposable problems. Of note, antibiotic resistance, carcinogenesis, pesticide resistance and adverse health effects, environmental pollution, disturbance of terrestrial and aquatic ecosystems, bioaccumulation and biomagnification, eutrophication, recalcitrance etc. and their chronic deleterious effects are few of the problems the world is facing and suffering continuously (Barai et al., 2017; Bonning, 2014; MacGowan & Macnaughton, 2017; Patricia Herńandez-Marťinez, Juan Ferŕe, & Escriche, 2009; "Progress on antibiotic resistance," 2018; Shishir et al., 2014). In addition, the climatic and anthropogenic changes are bringing about adverse effects on the environment, agriculture and health globally (Bellard, Bertelsmeier, Leadley, Thuiller, & Courchamp, 2012; Hoegh-Guldberg & Bruno, 2010; Potter, Arthur Woods, & Pincebourde, 2013; Taylor et al., 2013).

In solving these problems, holistic approaches coordinating sophisticated and state-of-the-art technologies from physical, chemical, computational and life sciences are being adopted. The developed countries have taken the advantages of recent maturation of technology in such cases especially with microbial biotechnology whereas the developing and least developed countries are still struggling and lagging behind miles (Ahasan & Partanen, 2001; Kleinman, 2010; Lustick & Zaman, 2011; Pickett, 2001). With the advent of sophisticated neoteric technologies and abstruse understandings in life science, even the very tiny life-threatening portion of the total microbial world was transformed into the 'Goldmines' (Ahmad, Khan, Aqil, & Singh, 2011; Barkay & Schaefer, 2001; Dewapriya & Kim, 2014; Mandal, Bolander, Mukhopadhyay, Sarkar, & Mukherjee, 2006; J. N. S, Srinivasan, & Devi, 2011; Vigneshvar, Sudhakumari, Senthilkumaran, & Prakash, 2016). Microbes being harnessed by appropriate molecular techniques are the keys to this magic that took place in the last century. Due to the numerous exquisite attributes such as ubiquity and diversity, the ability of fast multiplication and adaptation, synthesis of diverse useful metabolites and biomolecules, the decomposing ability of diverse biological and chemical wastes, compatibility in genetic modification, the feasibility of industrial production and purification, and eco-friendly in nature, microorganisms were exploited successfully in diverse beneficial sectors and a lot more are still to come (Bakker, Manter, Sheflin, Weir, & Vivanco, 2012; Claassens, Sousa, Dos Santos, De Vos, & Van Der Oost, 2016; Löffler & Edwards, 2006; Santero, Floriano, & Govantes, 2016; Tender et al., 2002; Toribio-Mateas, 2018).

Since exploitation of the already established potentials of tiny microbes is yet to be attained at a minimum level by the developing and underdeveloped countries, sincere attention, appropriate planning and priority-based initiatives should be into these sectors. Developing and incorporating microbe based eco-friendly processes and agents in agriculture, health, environment, industry and so on would be the key in eradicating various nuisances and simultaneously boosting up the economy. The scopes are usually broad, and the working areas should be prioritized based on the countries' current as well as prognostic situations.

Keywords: Microbial technology; Natural process; Artefacts; Eco-friendly solutions.

***Significance* | Solving Global Problems with Next Generation Microbial Application**

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Countries dependent on agriculture should have a special focus on eco-friendly cultivation techniques with bio-fertilizer, plant growth-promoting rhizobacteria, bio-intensive crop protectants such as bio-pesticides, bio-herbicides, bio-fungicides and bacteriocins etc. Again, waste management involving biotransformation and bioconversion would facilitate the production of biofuel, biogas, compost. Frequent use of antibiotics in livestock, poultry and aquaculture should be replaced using efficient and indigenous probiotic organisms to minimize the emergence of antibiotic resistance. Often, the industries in these countries are the major sources of toxic chemical release due to the lack or inefficient effluent treatment plants (ETP). This problem should be solved pragmatically by incorporating heavy metal accumulating and degrading microorganisms (Gadd, 1990; Ilias, Rafiqullah, Debnath, Mannan, & Mozammel Hoq, 2011) besides arranging required infrastructure in their facilities. Leather and textile industries, mostly situated in these countries, should involve microbe derived eco-friendly agents in different treatment steps of leathers and fabrics so that the environment, biodiversity and the public health are not at risk with harsh chemicals. Such agents are especially safer for their biodegradability and specificity and their synthesis is possible simply through the fermentation process. Therefore, screening, identification and characterization of potential microbes and developing bioprocess to produce them in large scale, should be prioritized for better management of the mentioned courses and strengthening the economy.

The pharmaceuticals are also leaning towards microbial world substituting the natural sources like plants, herbs or animals which have long been used in obtaining essential active ingredients. The limitations in productivity and recovery of active ingredients were solved with the appearance of recombinant DNA technology. Microbes are now being used as a unique biocatalyst for industrial-level production of useful metabolites. The compatibility of mass production of microbes in lesser space than that of plants and animals, functioning ability at mild temperature and pressure (thus saving energy), richness in diverse genes' pool that offer unlimited synthetic and degradative potentials and functioning as a suitable host for foreign genes etc. conferred them with tremendous advantages over the plants and animals (Bushell, 2003; Demain, 2014; Grossel, 1994; Hoq et al., 2013; Pandey, Soccol, Nigam, & Soccol, 2000; Patra, Das, & Shin, 2018; Sabra, Dietz, Tjahjasari, & Zeng, 2010).Thus the growing demand for pharmaceutical products was met by the scientists exploiting microorganisms and many lifesaving drugs were developed, used and improved gradually. In succession, diverse bioactive compounds with antibacterial, antifungal, anti-viral, anti-algal, antioxidant, antifouling, anti-cancer and enzymatic activities were discovered and utilized in relevant sectors (Bérdy, 2005; Ferdous, Shishir, Khan, & Hoq, 2018; Meena, Sharma, & Kanwar, 2017; J. S & Bharathi, 2018). In recent years, the successful discovery of novel bioactive compounds, especially from bacteria and fungi, has been attributed to the rapid development in advanced genetics, bioinformatics and computational biology, albeit with certain limitations in clinical and field trials (Adams & Weiner, 2005; Biankin, Piantadosi, & Hollingsworth, 2015; Demain, 2014; Fink & Shaw Warren, 2014; van Belkum et al., 2018; Wackett, 2017; Watkins, Stanton, Ryan, & Ross, 2017). Developing countries can take the advantages of such traits of microbes, especially in their pharmaceutical sectors.

The tiny microbes with appropriate use would become the key components of every sphere of life. Hence, tremendous concerted efforts are required to utilize such a valuable resource that could be obtained from every inch of the world.

Author contribution:

MAS composed the manuscript. MMH broached the idea and directed in the composition of the manuscript and did the meticulous revision.

Competing Interests

Authors disclose no potential conflicts of interest.

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