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Understanding the Common Antibiotic and Heavy Metal Resistant-Bacterial Load in the Textile Industrial Effluents

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Abstract : The effluents of textile industries have considerable amounts of heavy metals, causing potential microbial metal loads if discharged into the environment without treatment. Aim: In this present study, both lactose and non-lactose fermenting bacterial isolates were isolated from textile industrial effluents of a specific region of Bangladesh, named Savar, to compare and understand the load of heavy metals in these microorganisms determining the effects of heavy metal resistance properties on antibiotic resistance. Methods: Five different textile industrial canals of Savar were selected, and effluent samples were collected in 2016 between June to August. Total bacterial colony (TBC) was counted for day 1 to day 5 for 10-6 dilution of samples to 10-10 dilution. All the isolates were isolated and selected using 4 differential media, and tested for the determination of minimum inhibitory concentration (MIC) of heavy metals and antibiotic susceptibility test with plate assay method and modified Kirby-Bauer disc diffusion method, respectively. To detect the combined effect of heavy metals and antibiotics, a binary exposure experiment was performed, and to understand the plasmid profiling plasmid DNA was extracted by alkaline lysis method of some selective isolates. Results: Most of the cases, the colony forming units (CFU) per plate for 50 ul diluted sample were uncountable at 10-6 dilution, however, countable for 10-10 dilution and it didn't vary much from canal to canal. A total of 50 Shigella, 50 Salmonella, and 100 E.coli (Escherichia coli) like bacterial isolates were selected for this study where the MIC was less than or equal to 0.6 mM for 100% Shigella and Salmonella like isolates, however, only 3% E. coli like isolates had the same MIC for nickel (Ni). The MIC for chromium (Cr) was less than or equal to 2.0 mM for 16% Shigella, 20% Salmonella, and 17% E. coli like isolates. Around 60% of both Shigella and Salmonella, but only 20% of E.coli like isolates had a MIC of less than or equal to 1.2 mM for lead (Pb). The most prevalent resistant pattern for azithromycin (AZM) for Shigella and Salmonella like isolates was found 38% and 48%, respectively; however, for E.coli like isolates, the highest pattern (36%) was found for sulfamethoxazole-trimethoprim (SXT). In the binary exposure experiment, antibiotic zone of inhibition was mostly increased in the presence of heavy metals for all types of isolates. The highest sized plasmid was found 21 Kb and 14 Kb for lactose and non-lactose fermenting isolates, respectively. Conclusion: Microbial resistance to antibiotics and metal ions, has potential health hazards because these traits are generally associated with transmissible plasmids. Microorganisms resistant to antibiotics and tolerant to metals appear as a result of exposure to metal-contaminated environments.

Keywords : antibiotics, effluents, heavy metals, minimum inhibitory concentration, resistance
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