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BROWNFIELD RECYCLING - REHABILITATION OF A FORMER INDUSTRIAL AREA THROUGH THE TECHNIQUE OF ADVANCED CHEMICAL TREATMENT FOR HEAVY METALS

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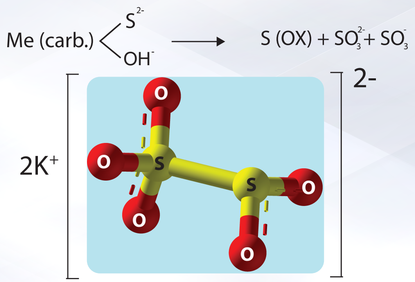
INTRODUCTION: The issue of contaminated areas has been hotly debated in the business community because it involves high costs and many difficulties of a legal, institutional and communication character, creating problems for urban management with depreciation of properties and its surroundings. This study presents the main results of a contaminated soil and groundwater remediation projects related to an urban area in São Paulo city, where the chemical stabilization was pointed out as the best possible alternative from the technical and economical perspective for that area rehabilitation.

Figure 1
Degraded Area in São Paulo - Brazil

METHOD: The site remediation project plan was based in the remediation technology known as Advanced Chemicals Treatment, focusing a very short schedule and results needs, keeping the area free of toxicological risks to human health and the environment. Most metals ions may be precipitated as hydroxide or oxide at high pH values, however, some precipitates can be redissolved in excess of OH. Heavy Metals precipitation processes in the form of sulfides and hydroxides sulfides are generally more insoluble than the hydroxides and less subject to the action of complexing agents and may be precipitated in a unique pH level forming insoluble compounds with heavy metals.

(Equation 1). This paper aims to present the results of a remediation project held in in a former contaminaded industrial site affected with a groundwater heavy metals contamination, through the precipitation of a heavy metals in the form of (ox/hidroxy) sulfides.



Equation 1

Equation 1: The step of activating the metabisulfite is to promote the reaction with other substrates such as alkaline earth metal salts, in a way that it promotes the sulfites radical, which is co-precipitative in "coordination complexes". There are several techniques for activation , such as electrons donors, pHxEh, bufferings, that are the mostly employed.

RESULTS: The technique consisted in the injection of a solution containing metabisulfite (S_2O^{2-}) and activation substracts which deliveries the radical calcium polysulfate. The radical allows ion exchange with the heavy metals at pH/Eh buffered conditions precipitating the heavy metals ions in their lowest oxidation state. The assessment of these technical efficiency was demonstrated monitoring the groundwater, just 15 days after the remediation agent application indicating reduction range from 99% to 100% of the initial concentration of metal contents dissolved in groundwater remaine stable conditions of pH/Eh. **Figure 2** shows the heavy metal concentrations before remediation (October / 2015) and 10 months after remediation (August / 2016).

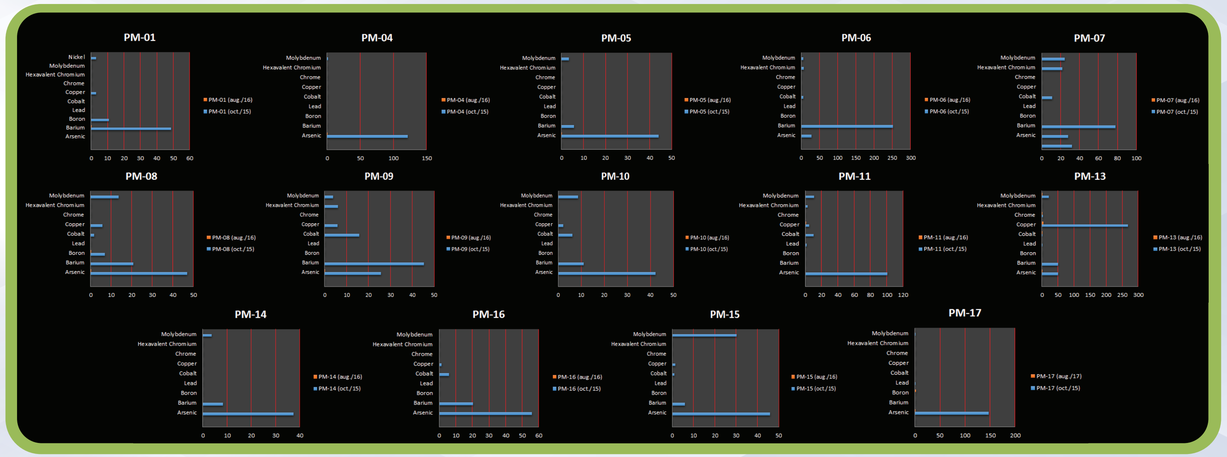


Figure 2 : Metal concentrations before remediation and 10 months after remediation.

The reaction with Metaldown® provides sufficient pH/Eh buffering conditions to maintain the CO-PRECIPITATIVE PROCESS available for the reaction allows full mineralization and the final products is stable, letting to a very low Ks (<10-30) solubility constant. In the case of contaminated soils, the ACT allows the treatment to be on site, which minimizes not only the operational costs, but also the risks inherent in handling and transporting the contaminated soil, when compared to the ex situ treatment. **Figure 3** shows the solubility of the remaining metals.

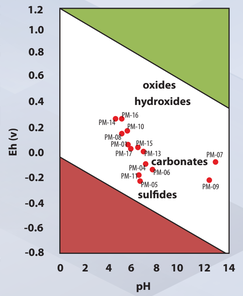


Figure 3 : Solubility according to pH and Eh

CONCLUSION: The ACT with Metaldown® allows the treatment to be accomplished on site minimizing not only operating costs but also the deadline for the rehabilitation of a former industrial contaminated heavy metals area. Thanks to that, the area could be re-inserted art the economic dynamics of the city.