APB-BART reactions

Quick Break Training **14 March 2009**

Corrosion has been traditionally connected to the ability of sulfate reducing bacteria (SRB) to generate hydrogen sulfide that then triggers the electrolytic corrosion of metallic alloys such as steels. Another group of bacteria are also able to trigger corrosive processes by the generation of organic acids during reductive fermentation of organics. These acidic products are relatively mild dropping the pH down into the range of 3.0 to 5.5 that is still sufficient to cause structural weakening of concretes and many metals. While SRB often generates a dramatic type of corrosion causing perforation of steel plates (as an example) the acid producing bacteria (APB) cause generalized embrittlements and structural failures. Both SRB and APB tend to thrive in reductive environments with the SRB dominated in high sulfate / sulfur and the APB under conditions which are organic rich (e.g. biomass, biofilms). More and more corrosion management practices are paying more attention to the determination of the activities of APB as well as SRB.

Acid producing bacteria (APB) are formed by a variety of general (heterotrophic) bacteria that share the common ability to produce organic acidic products when growing under reductive conditions utilizing organics. These APB cause the pH to drop significantly from neutral to acidic conditions ranging from terminal pH levels from 3.0 to 5.5. These mildly acidic conditions are sufficiently corrosive to be significant to the integrity of any metallic or concrete structures being impacted. Because of these acid-producing activities in the absence of oxygen, it has been found that the APB are very likely to be significant partners in corrosion with the sulfate reducing bacteria (SRB) particularly in the oil and gas industry. As a result the management and control of corrosion frequently involves assessing the aggressivity of both the APB as well as the well-recognized SRB.

While corrosion was thought of as primarily electrolytic it was observed that some MIC was acidulolytic and caused by bacteria able to generate acid products generally under highly organic and reductive conditions. Today it is now recognized that the APB are significant contributors to corrosive processes though the compromise to the metals through a gradual dissolution of the metal under the very acidic conditions that are created. In general the APB communities are found to be active under reductive conditions within biofilms, slimes, encrustations, nodules and tubercles. Their activity can sometimes be noted as a lateral erosion of the metal surface that can be most clearly seen the metal surface is examined using reflective light. Much of the APB is usually located at the metal – biomass interface. If present, the surface of the metal will appear to have an irregular pattern of shallow depressions. This would mean that the most effective examination of a sample for the presence of APB would be achieved by sampling the slime / concretion / encrustation / nodule / tubercle immediately at the interface between the growth and the metal surface. It should be remembered that this test is pH dependent and so any samples to be tested using the APB-BART should have the sample's pH adjusted to higher than 6.5 in order to ensure that there is not a false initial positive. The tester should start out with a purple color that turns yellow when acidic products are detected.

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