DN-BART Reaction Patterns

Quick Break Training

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Denitrifying bacteria have one common feature which is to reduce nitrate (or nitrite) to nitrogen gas. Both nitrate and nitrite are products of the oxidative metabolism in which ammonium is oxidized through nitrite to nitrate by nitrifying bacteria. Commonly denitrifying bacteria dominate waters that are rich in organics and nitrate. They will reduce the nitrates to nitrogen gas via nitrite. If denitrifying bacteria are found to be active in a water sample it means that the following conditions exist in the water sample: (1) water is moving from an oxidative to a reductive state (e.g. ORP becoming negative); (2) water has become subject to the activities of nitrifying bacteria under upstream oxidative conditions; and (3) organics present in the water had a relatively high nitrogen content. Denitrifiers can therefore be expected to be very active when waters rich in organics (and particularly proteins) moves from reductive (producing ammonium) to oxidative (causing nitrification of the ammonium to nitrates) and then back to reductive when the denitrifiers now dominate reducing the nitrate (and nitrite) down to nitrogen gas. This can be viewed as one of the natural systems by which nitrates are controlled.

Denitrifiers when detected using the DN-BART tester have only one possible reaction: (FO) which is the foam ring that forms around the BART ball when nitrates and/or nitrites are being reduced to nitrogen gas. Generally this FO reaction occurs with a time lapse of three to five days and this gives an indication of how active the denitrifiers are in the sample with three days being very active and five days detectable. In some cases the time lapse will be shorter (i.e. one or two days). This is relatively rare and indicates the sample was taken from nitrate rich water that has just shifted from an oxidative to a reductive state. Generally the denitrifiers become much less active when the environment has become very reductive and the nitrate sources have all been used up.

Positive detection of denitrifying bacterial activity is the formation of a foam ring around the BART ball commonly between days 3 and 5. Occurrences of isolated gas bubbles on the wall of the vial or on the underside of the BART ball should be treated as negative since many bacterial activities can generate these types of bubbles. The foam ring can be considered formed when there is a ring of bubbles extending at least three quarters of the way round the ball. This foam ring should continue to grow to form a continuous ring of foam around the ball that should last for at least 24 hours.

In practise the DN-BART tester is particularly useful when significant nitrates have been detected in waters but they will only become very active when the oxidation reduction potential (ORP) has dropped and moving towards negative millivolt readings. A twin test of value is the N-BART tester which detects nitrifying bacteria that generate nitrates in oxidative waters from ammonium where the ORP values are registered in positive millivolts. Where surface waters are found to contain nitrates then there is a probability that nitrifying bacteria are present and active. It can be considered a high probability that there will be a bloom in denitrifiers when the aquatic environment becomes reductive.

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