

PASSIVE REMEDIATION OF ACID PRECIPITATION USING CRAB-SHELL CHITIN: A TREATABILITY STUDY¹

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Abstract: The South Branch of Kinzua Creek is located within the Allegheny National Forest in McKean County, Pennsylvania. Due to anthropogenically induced acid precipitation and low buffering capacity of the native surface geology, low pHs have been observed in the tributaries of the creek ranging from 4.30 to 4.34, many with low levels of aluminum (0.6 mg/L). Since the South Branch of Kinzua Creek is managed as a Wilderness Trout Water, this area is of great concern to The Pennsylvania State Fish and Boat Commission. It is hoped that by restoring the water quality of tributaries in this area, the re-establishment of self-sustaining populations of Brook Trout populations will soon follow.

One method that has been used to help restore circum-neutral pH conditions to streams affected by acid precipitation is to treat stormwater runoff from roads using ditch-lined passive treatment systems. Traditionally, limestone rock has been used in these systems as an alkaline agent to neutralize the acidity of the runoff. In this laboratory study, we evaluated the use of crab-shell chitin as an alternative source of alkalinity to supply additional buffering capacity to the watershed.

In batch microcosm experiments containing acid rain impacted stream water, crab-shell chitin increased the pH from 3.1 to 7.6 – 8.2 and the alkalinity from 0 to 37.2 – 136.8 mg/L as CaCO₃ after treatment times of 6 h – 10 d, respectively. Similarly, under continuous-flow conditions, crab-shell chitin maintained an average pH of 7.5, an alkalinity of 634 mg/L as CaCO₃, and removed aluminum for the duration of the 54-d study. By comparison, limestone only reached a maximum alkalinity of 22.8 mg/L as CaCO₃, and was not able to maintain aluminum removal. This work suggests that crab-shell chitin may be an effective alternative substrate for the restoration of waters impacted by acid rain due to its ability to provide excess alkalinity and remove metals, all with lower mass requirements than limestone.

Additional Key Words: Acid rain, passive treatment, limestone, aluminum.

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