Investigating applicability of Kirpich method for estimating time of concentration of flood

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Time parameters are used mostly in hydrologic and hydrolic models. The most often used time parameter in hydrology is time of concentration.

Time of Concentration is the time required for a particle of water to travel from the hydrologically most distant point in the watershed to outlet or designing point. Time of Concentration is used for designing spillway, estimating flood volume, preparing flood hydrograph and many other hydrologic analyses.

Many methods (empirical equations) are available for estimating time of concentration. Among the empirical time of concentration methods, the kirpich method has found wide-spread use, especially in the rational method applications.

The aim of this research is investigating applicability of kirpich method for estimating time of concentration in the studied basin. To achieve the said aim, a field method based on measurement of travel time by salt solution is used, then the difference between values obtained by using kirpich method and the field method is determined.

Results of this research show that kirpich method is best suited for watersheds with slopes ranging from 3 to 7 percent, but the method is not applicable for watershed with slopes outside this range.

Metal-mineral-microbe interactions in experimental microcosms using New Zealand thermophiles

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Experimental microcosms using inoculants from New Zealand hot spring areas have been used to grow micro-organisms that produce biogenic elemental sulfur. Several metals have been added to these microcosms to test the hypothesis that biogenic sulfur has properties that differ from its abiogenic equivalent.

The apparatus consists of a bioreactor capable of temperature and pH control and a peristaltic pump providing concentrated Na_2S solution feed. Minimal media is used in all experiments. Several control experiments were made using sterilized media only, media with sulfide feed, and bacteria-only using *Anoxybacillus flavithermus*. The sulfide-oxidizing cultures are initially grown in minimal media in serum bottles. These concentrated cultures are added to the bioreactor that is initally at pH 4. Once sufficient bacterial growth has occurred, excess H_2S is purged using N_2. The suite of metals is added to give a concentration of 2 – 4 ppm. The bioreactor is sampled as the pH is shifted from 4 to 8 and then back down to 3 in single pH unit intervals. Samples of unfiltered, filtered and digested (dilute aqua regia at 95°C overnight) media were collected.

The system is complex and includes: inorganic mineral reactions; bacterial interactions with dissolved metals and particulates; interactions with biogenic sulfur; and the effects of settling in the bioreactor. Initial interpretations are based on chemical analysis and SEM EDS study. Divalent cations including Cd, Co, Mn, Ni, Zn and Sr show adsorptive behaviour (or possibly reversible hydroxide precipitation and dissolution). Other elements such as Al, Fe, Ga, and In precipitate as metal hydroxides with filtered samples containing no measurable metal at pH values above about 5 but reappearing in filtered samples when pH was decreased. Metals including Ag, Au, Bi, Cr, Cu, Hg, Sb and Pb show variable behaviour with some evidence of segregation in mineral precipitates and some evidence of adsorption.

16S rDNA gene analysis indicated that the bioreactor community consisted of three phylogenetic groupings related to *Acidicaldus*, a sulfur-oxidising heterotroph; *Acidobacterium*, a chemo-organotroph and *Thiomonas*, a sulfur-oxidizing facultative chemolithoautotroph.