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APPLICATION OF DIFFUSION–REACTION EQUATIONS TO MODEL CARIOUS LESION PROGRESS

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ABSTRACT

We develop a theoretical model of carious lesion progress caused by acids diffusing into the tooth enamel from the dental plaque. The system under consideration consists of two initially separated substances A (an acid causing caries) and C (a static enamel mineral) which react chemically according to the formula $A + C \to \emptyset(\text{inert})$. The model utilizes nonlinear diffusion–reaction equations describing the diffusion–reaction process with one static and one mobile substance. The so-called surface layer, which is formed in this process and in which chemical reactions can be neglected, is also included in the model. Changes in substances' concentrations are calculated approximately by means of the perturbation method. We show that experimental data on the enamel mineral concentrations are well described by the analytical solutions of the diffusion–reaction equations.

REFERENCES

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