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This Week's Citation Classic

Brenner H. The diffusion model of longitudinal mixing in beds of finite length. Numerical values. *Chem. Eng. Sci.* **17**:229-43, 1962.
[Dept. Chemical Engineering, New York Univ., New York, NY]

Accurate numerical values are tabulated pertaining to the solution of the partial differential equation governing miscible fluid displacement dispersion phenomena in finite beds. Nondimensional results are furnished for the instantaneous exit solute concentration and average solute concentration remaining. Various asymptotic cases are discussed. [The *SCI*® indicates that this paper has been cited over 125 times since 1962.]

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"This paper arose from consulting activities performed for the Dorr-Oliver Corporation in the late-1950s and early-1960s in my loosely defined capacity as an external consultant on long-range, 'fundamental' research programs—a role fortunately divorced from their frenetic day-to-day operating problems, to whose resolution I had precious little to contribute. At the time I was an untenured junior member of the chemical engineering faculty at the now defunct Bronx campus of New York University (on whose IBM 650 computer the numerical calculations were actually performed). This New York location left me conveniently poised for a relaxed, twice-a-month contractual visit to the Dorr-Oliver research facilities in nearby Westport, Connecticut. With three young daughters, a nonworking spouse, and a newly acquired (and heavily mortgaged) house in suburban Long Island, this cozy (albeit financially modest) consulting arrangement permitted me and my family the luxury of eating. (Junior faculty salaries at private schools in New York City at the time were not meant to encourage frequent pursuit of this latter habit.)

"E. Bryant Fitch, then Dorr-Oliver's research director, was keenly interested in practical problems relating to the washing of filter cakes on continuous, rotary-drum vacuum filters. Rationalizing the less-than-perfect interstitial fluid displacement process, observed to occur during the washing portion of the filtration cycle, was a favored intellectual preoccupation, indeed hobby, of his. Discussion of this topic occurred frequently during my Westport visits, since I was one of the few persons privy to company 'secrets' whose mathematical acumen and knowledge of transport phenomena was suitable to the task. Fitch's tenacious interest in the problem, coupled with my resolve to do something that would be deemed worthwhile by my industrial sponsors (read: ingratiate myself with the 'hand that fed me') and, at the same time, deemed academically acceptable by my senior university colleagues (read: 'publishable'), led to my writing the paper cited. That this rare confluence of mutually acceptable industrial/university research criteria should, more than 20 years later, have produced a *Citation Classic* seems remarkable to me in retrospect.

"Why is the paper so frequently cited? Almost certainly because of the comprehensive and accurate tables and graphs appended to the article. Simple, easy-to-understand comparisons between these numerics and several idealized limiting cases (pure displacement at one extreme and perfect mixing at the other) presumably add to its intellectual digestability. Last, but not least, the article is directed toward potential industrial research applications, more so than any other article I had written before or have written since.

"The original article accepted without question the phenomenological equations underlying solute dispersion phenomena in porous media. Only recently have I begun to understand[1,2] the physical basis behind these empirical dispersion laws."

1. **Brenner H.** Dispersion resulting from flow through spatially periodic porous media. *Phil. Trans. Roy. Soc. London A* **297**:81-133, 1980.
2. ———. A general theory of Taylor dispersion phenomena. *Physicochem. Hydrodyn.* **1**:91-123, 1980.