

Quantitative equilibrium calculations

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Sorption kinetics of nitrobenzenen

You are working on a project that assesses indoor air pollution by organic chemicals. In this context, you are asked to measure the sorption kinetics of nitrobenzene from air into foam. To this end, you place a piece of foam into a temperature-controlled box with a volume of 30 m^3 . You then introduce NBZ to the box. To accurately measure the kinetics, you need to achieve an equilibrium uptake of 90% of the initially added NBZ into the foam (i.e., this is the distribution at partition equilibrium). The remaining 10 % remains in the air of the box.

How much foam do you have to add to the box to achieve this final distribution? Assume that the box contains only the foam and air and that distribution into the walls of the box is negligible.

The experiment is carried out at 25°C . The equilibrium partitioning between foam (per g) and air (per L) at 25°C for NBZ is 151 L/g .

Help: The spreadsheets (Mehr-Phasensystem.xls) are not designed for this type of question, i.e. the unknown variable (i.e. the mass of sorbent) is asked for as input information in the spreadsheets and the given information (i.e. sorbed fraction ought to be 90%) is part of the output of the spreadsheet. You can either redesign the spreadsheet (preferred solution because most sustainable if this situation occurs again), or you can do the calculation by hand (transforming equation?) or you can use the provided spread sheets in an iterative trial-and-error way (probably the quickest but not the most elegant way of solving the problem).

Answer: 1.8 kg foam should be used in the experiment.



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