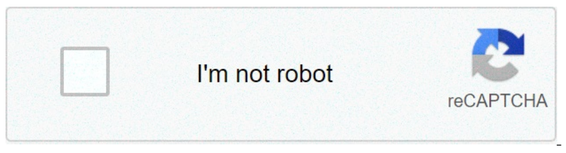

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Eddy diffusion in chromatography

Consider that a group of molecules flowing through a packed particle bed (figure 21). Another way of thinking about this is to imagine you and a group of friends following a river downstream in a series of air rooms. The river has a series of rocks in the way and a variety of different flow paths through the rocks. Several people go to different channels or because they remano towards them or come to different power streams while bouncing obstacles. Figure 21. Representation of a chromatographic column rich in particles. The question we need to consider is if different molecules would have different lengths of the path as they passed through the bed. Would every person traveling along the river trip a slightly different distance, or would you run to all the exact same distance? I suspect we can see that the different molecules would end up with different lengths travel as shown in figure 22. A molecule (molecule 1) could find a relatively simple shot through the packed bed, while another could meet more particles that had to be circumvented (molecules 2 and 3). If you look at a group of molecules they pass through a packed bed, and then traced each path with a length of rope, we would see if all the strings are lying down, that there was a distribution of path lengths with some more short and some being more long. If so, the molecule with the shortest length of the route would move through the column more quickly (Molecule 1). The molecule, with the length of the longest route to move through the column more slowly (molecule 3). If we have a distinction between the time that employs a set of molecules to move through the column based only on different path lengths, we have expanded the peak. This is known as a parasitic diffusion. Figure 22. Representation of the different paths of three different molecules traveling through a packed particle bed. A key factor to consider when examining parasitic diffusion is to ask if the length difference between the shortest and longer path depends on the diameter of the particles. If it is, you could then ask that the particles (minor or greater) would lead to a greater difference in the length of the route? Almost all those who ask the first question seems to be intuitively realized that the particle size must somehow make a difference. It seems too much coincidence to think that the difference between the shortest and most long journey would be identical if the particle size is different. But quite interesting, almost everyone, when they consider this first, it seems to select the wrong answer when to understand which of the particles (small or large) would lead to a greater difference in the length of the path between the shortest and most long journey. Remember, the important distinction is the size of the difference between the shortest and most long journey, it is not if a column would have evenly have lengths of the most long journey of the others. For help with this evaluation, two columns are depicted in figure 23, one with small particles, the other with larger particles. Figure 23. Representation of two columns with particles of different sizes. Note that the greater difference between two molecules occurs, one of which has found a relatively simple shot through the column, the other of which he met a lot of particles and so he has to travel in them. Note also that the distance needs a molecule to travel throughout a bigger particle is larger. Now you might be inclined to say that if we have to travel around a lot of small particles, would not then add up to the greatest distance to travel to Biggest particle? Discover that it is necessary! The conclusion is that the smaller particles will reduce the eddy-peak extension distribution (although we will add a reserve in a bit). In other words, the distribution of path lengths of a set of molecules traveling through a packed bed is more uniform for a bed containing smaller small particles It is for a bed made from larger particles. Therefore, with regard to the eddy diffusion, V'a a theoretical advantage of using smaller particles. This is the reason we use the reduced plate height (h = H / dp) instead of the height plate for an overall efficiency assessment column. If we had two people packed a column with the idea of seeing it packed a better one, if a person used smaller particles would have a competitive advantage if only compared the plate height (H). It is also worth realizing that the flow profile shown in Figure 24 for a molecule would not occur (OK, thereâ ¢ s probably some infinitesimal chance that this could happen, but itÃ ¢ s so small that we could ignore it) in a chromatography column. There is a physical flow pushing the material through the column and when a molecule reaches an area flowing, will generally be dragged downstream. Figure 24. unrealistic representation of the flow profile for a molecule through a chromatographic column packed. Some packed columns show ducting, channeling and leads to a considerable and undesirable amount of eddy diffusion. The illustration in Figure 25 shows a column with a channel and compares two flow paths, one of which goes through the channel. Figure 25. Representation chromatographic column packed with a channel. Channels provide a straight path through a portion of the column, and molecules in a channel to avoid the need to move any particles. A molecule that moves through a much more streamlined path will have a channel or shorter of a molecule in an adjacent part of the column that must pass through the packed bed. Channels occurs when the particles stick together in some way and separated from one another instead of nesting together in a packing arrangement with each particle close together. A column chromatographic liquid that is dried (all the mobile phase is allowed to evaporate) probably develop channels during the drying process that never close up if it is moistened. Channels in chromatographic columns are undesirable and introduce a lot to expand the system. Another key thing to ask is whether then channeling is more likely to occur with smaller or larger particles. Channeling will occur if a column is poorly packaged. There are well-defined procedures that have been developed for packing chromatographic columns gases and liquids that are designed to minimize the possibility that channeling occurs. A key to packing a good column is slowly established along a bed of particles so that nest into each other in the best possible way. The packaging a gas chromatographic column, this usually involves slowly adding the particles to the vibrating column so that the particles are deposited together. liquid chromatography columns are usually packaged slowly under high pressure. A column is packed efficiently when the particles are in a uniform bed with the minimum amount of voids. Given a particular particle size, the aim is to adapt the largest possible number of them in the column. We can then ask which is more difficult for the packing of particles in an efficient manner, more or less large. One way to think about this is that if one else has been asked to fill a large box (say a refrigerator box) with basketballs and tennis balls. The goal is to meet as many of one as possible. You could easily imagine taking the time to Arrange each basket in the refrigerator box, layer by layer, and fitting in as many basketballs as possible. He might even be able to imagine that you would start slowly with tennis balls, laying them in one in a time, and quickly lose patience as it would have been necessary to fill the entire box. If then accelerated, say slowing down dumping balls from a bucket while a helper shook the box, you would probably create more empty in the box. Moreover, since interstitial volumes between tennis balls will be less than that with basketball balloons, the canals become more significant. The result is the one It is more difficult to avoid the formation of canals with smaller particles. Reincomplacement, smaller particles have a theoretical advantage over larger particles, but more care must be exercised when smaller particle packaging if this theoretical advantage of the column must be realized. Do the capillary tubular columns open spreading Eddy? Capillary columns do not have the packaging material. Instead, they are long, narrow diameter tubes that have a coating of a liquid stationary phase on the inside walls of the column. A representation of a capillary column with a uniform liquid coating on the walls is shown in figure 26. Figure 26. Representation of a coated capillary column. Because there is no packaging material to move, there would be no parasitic diffusion in that column a. The absence of parasitic diffusion expansion is an advantage that capillar columns have compared to packaged columns. Finally, you might ask if the spread Eddy exhibits every dependence of the scope. This actually turns out to be a difficult question to respond with conflicting opinions and data on the fact that there is a flow addiction, and if yes, exactly what addiction is. If we return to the van DEEMTERÃ ¢ s initial development of the peak expand in chromatography in 1956, we would see that Van Deemter believes that the Eddy spread contribution to the speech enlargement did not depend on any way. It is a reasonable topic, if we thought we could have drawn a variety of different flow paths through a packed bed, and the length difference between the shortest and longest flow path would have been repaired regardless of how fast the Molecules moved through the path. But let's back to our river analogy to see how the flow rate could be involved in this. Suppose the river had a relatively fast rate flowing, in such a way that different people in different air chambers obtained blocked in particular flow channels and remained in those all the way along the river. Based on this situation, each path will have a predetermined length and even if we slowed the flow, so long as it was blocked in a particular path, the difference away would be invariant. But suppose we have now slowed the flow so much that there were opportunities to drift around points and enjoy a variety of flow paths along the river. This could lead to some compensation and the quantity of sampling of different flow paths would be slow to slow flow. This same thing can happen in a chromatographic column and leads to contrasting data and opinions about the nature of each dependence on the parasitic diffusion. Furthermore, the exact point in which there is a cross between a rapid flow that locks in a slow flow path that allows each molecule of many sample routes flowers different it is impossible to determine. This point is still not completely solved, and the literature on the extension bandwidth displays different terms for parasitic diffusion. We normally spread Eddy index with the term A. If you look at the initial treatment Van DeemterÃ ¢ peak expansion, you should see (note, Van Deemter also didn't use the reduced flat height, but we could write H = to how Well): H = A (where A = 2i Â "DP) note how the particle diameter (DP) is included in this equation for A, so that smaller is the diameter of particles, minor is the contribution of eddy diffusion to reduced plate height. Another common conclusion today is that the Eddy spread enlargement contribution does not have a slight dependence on reach. The usual form of this is that addiction is v1 / 3, You could often see books or items that include the following term in the global enlargement band equation. H = A V1 / 3 Still other people raise your hands to all the confusion regarding the parasitic diffusion and show the general enlargement band that has no ends in them. We will develop another term expansion that it has to do with the processes in progress in the mobile phase (and note that the spread Eddy Eddy It involves the mobile phase - no one of which we have spoken also requires the presence of a liquid stationary phase), so some people absorb the defusion deadline of Eddy in this other mobile phase term. term.

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