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Recovery Studies for Different Surfaces for Rinse Sampling

Last month we covered recovery studies for different surfaces for swab sampling. This month's topic is recovery studies for different surfaces for rinse sampling. Shouldn't exactly the same practices applied to swab sampling apply to rinse sampling? Well, the same principles apply, but how it is fleshed out in practice is slightly different. What makes rinse sampling different from swab sampling for doing recovery studies? The main difference is generally (but not always) that in swab sampling I am only sampling one material of construction (MOC) at a time. In swab sampling, I may sample different materials in a cleaning validation protocol, but generally I am sampling different surfaces in separate swabbing events. In rinse sampling, I generally am sampling an entire equipment item. If it contains multiple MOC's, then I am sampling those items together as a unit. If I have a vessel with stainless steel sidewalls and plastic scrapers, in rinse sampling I generally do not sample only the stainless steel surfaces, and in a separate rinse sample only the plastic scrapers.

Just for illustration, an example where in rinse sampling I would be sampling only one surface would be in rinse sampling for small parts; for example, if I do rinse sampling of filling needles, that generally would only involve one surface type. And, an example from swab sampling where I would swab multiple surfaces in a cleaning validation protocol would be sampling at the interface of stainless steel and an EPDM gasket in a tank. In the latter example, I could theoretically sample only the stainless near the interface, and then sample only the EPDM near the interface. However, I wouldn't generally do that because the area of most interest for sampling is the interface between the two surfaces (an area more likely to have higher levels of residues).

Now that I've discussed the exceptions, let's get back to the primary concern, which is dealing with recovery studies for rinse sampling where I am dealing with multiple MOC's in the equipment. The simplest way to deal with this situation is to just perform rinse sampling recovery studies on each material, and then utilize the lowest recovery of any material as the "official" recovery percentage for that sampling situation. For example, suppose my tank contained three MOC's: stainless steel, PTFE and EPDM. In that case I would perform three recovery studies, one on each of the three MOC's. Remember that as a rule, rinse recovery studies do not have the variability of swab sampling, so one operator performing three replicates on one surface at one spiked level (the spiked level being the surface area limit, or L3 in my terminology). So if I run a study on each MOC, suppose I obtain recovery values of 85% for stainless steel, 81% for PTFE, and 78% for EPDM. In the simplest approach, what I would do is utilize the lowest percent recovery of any material tested as my "official" recovery percentage. In this case, that "official" percentage would be 78%. In other words, if my approach was to correct the protocol analytical data by the rinse recovery percentage, I would correct rinse analytical results (for rinsing involving all three MOC's) by a factor of 78%.

But, you ask, "The stainless steel is 97.5% of the surface area, PTFE is 2% and EPDM is 0.5%. Shouldn't I weight each recovery percentage and come out with some intermediate value?" If so, using the rinse recovery data presented in the previous paragraph, this approach would involve saying that my "official' recovery percentage would be calculated as follows, by weighting the surface areas:

% Recovery = (85%)(0.975) + (81%)(0.02) + (78%)(0.005) = 84.8%

While it might be tempting to use this approach, it is not scientifically justified. It would work if the amount of residue on each surface were exactly the same in a cleaning validation protocol. However, one doesn't know the amount of residue on each surface (if one did, then there would be no point in doing rinse sampling). Try it with some simple examples where the levels of residues are different on the surfaces to confirm that it is not a sound practice. It may be close enough in certain circumstances, but this practice should (in general) be avoided.

So weighting of the surfaces and recoveries is not acceptable. Is there any situation, analogous to the "threshold" concept used for swab recovery study, to reduce the number of rinse sample recovery studies to be done? Well, yes. It involves the same principle, applied slightly differently. In the case of rinse sampling if a surface constitutes less than a threshold percentage of the total area sampled, then it may be possible to not perform a rinse recovery on that surface. In that case, then the recovery attributed to that surface should be either the minimum acceptable recovery (such as 50%) or the lowest recovery percentage of any similar material for which a rinse recovery percentage was established. Note here, however, that the threshold value is the percentage (such as 1% or 2%) of the total area sampled for that equipment item, not the total area of the equipment train. The reason for this is that the total equipment train may have less than 1% of a given surface type, but for an individual item rinse sampled, there may be a much larger percentage of the surface sampled in that rinse situation.

This brings us to the last option, "Can I group surfaces for rinse recovery studies, much like what has been proposed for swab recovery studies?" The answer is that it appears to be a useful approach. But, there has been very little published on rinse recovery studies, much less on comparing rinse recovery studies on different materials of construction. It might be tempting to say that if two materials have essentially the same swab recovery percentages, that they should have the same rinse recovery percentage. For clarification, I don't mean that the rinse recovery value will be the same as the swab recovery, but that the rinse recovery values (whatever values they are) will be the same for each of the MOC's. The reason we should avoid this approach at this time is twofold. One is that rinse sampling is different from swab sampling (rinse sampling does not have the mechanical action of removal that is present in swab sampling). Secondly, there is not enough data published in rinse recovery studies to allow us to begin to make conclusions. However, when enough data becomes publically available (or if a company develops that data for its use), then a grouping approach for rinse sampling MOC's should be possible. Note, however, that what this means is that a company will have to do fewer recovery studies on new residues; if rinse sampling is done on an item with multiple MOC's, it will still involve the approach of using the lowest percent recovery of any MOC for the "official" rinse sampling recovery.

Just like for swab sampling, which option is being utilized for addressing different materials of construction for rinse sampling recoveries should be specified in the company's cleaning validation master plan (or other name for the high level document that controls what is done for cleaning validation protocols). It just makes good sense to be clear in that document on the approach being taken.