Please note the following as an assignment. It is a group assignment. You can form a group of maximum two and work on this. It is essentially a case study and each group has to come out with their own creative ideas in the presentation. You can submit it latest by 10th March 2021 . You can present it as an extended write up for three pages maximum or as five to six ppt slides also. The choice is left to the group.

*A medium scale chemical manufacturing unit synthesizes a sulfonated product of toluene by the reaction of toluene with oleum. After the reaction is completed, the mixture is diluted with water and then transported using tankers to customers who use the product in metal finishing business. Unexpectedly, the customers did not accept the product as they noticed some kind of a brownish colored sludge in the product.*

*The plant manager of the manufacturing unit brings the sample to you and as an experienced analytical chemist how would you assess this problem from diverse perspectives and make a concrete plan for chemical analysis as well.*

*Come out with a thorough and critical assessment of the problem and the solution.*

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1. The suspicions that we have, whatsapp photo
2. Then, we will perform the analysis assuming that the metal tanker has caused the impurity (technical word?)
3. We will take the sample with precautions and proper procedure(Refer the sampling methods)
4. Then, we will do sample pretreatment like (crushing, pulverising and grinding) so that our sample is homogeneous and representative of the sample.
5. We take a part of the sample for analysis to the laboratory.

**ANALYSIS**

**START**

The reaction of toluene with oleum results in the formation of toluene sulphonic acids, of which the *para-* the compound is the major product (tosylic acid). The formation of brown sludge will be the problem that needs to be tackled. For that, we look into the procedure followed the conditions, the reagents involved (right from the synthesis) and finally, the transportation for possible clues.

After inspecting these, we conclude that the possible culprits are:

* Impure reactants i.e. not of AR/LR grade
* A mixture of *ortho-* and *para-substituted* products
* The water used for the dilution might contain impurities or might not have been distilled or might be relatively hard (contain high concentrations of Cl- or (CO3)2-)
* The variation in temperature during the reaction or when the product was being transported
* The walls of the tanker used for the transport of the product could lead to some kind of metal contamination, especially if the steel used is of a lower grade and is not chemically inert

We start with the possibility of contamination via the steel used to manufacture the tankers.

To confirm our suspicions, we would try to take a sample of the brownish sludge carefully with precautions like wearing masks, gloves as TsOH is a strong acid, and the product contains organic compounds that are volatile and may cause respiratory disorders. After we carefully take a sample from different areas of the tanker, we need to perform sample pre-treatment before we analyse it. We will take our sample and churn it properly to get a homogenous mixture. Then we will create turbulence and we will collect our sample in poly-propylene beakers to prevent adsorption and label the sample bottles and use this final sample which contains our analyte for our analysis.