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We have seen that, CTAB proves to be an important component, as surfactant in our experiment. But it is also necessary to optimize and search for alternative surfactant. CTAB itself is partly organic with long carbon chain and partly ionic. Thus, we begin analyzing by varying the chain length of the carbon chain. This gives rise to dodecyl trimethylammoniumbromide (DTAB), tetradecyltrimethylammoniumbromide (TTAB) and so on. By varying the carbon chain length (by increasing the chain length), the nanoparticle size decreases, under similar condition. Thus, to obtain nanomaterial with certain geometric aspect, varying the chain length can be a better optimization.

Though the above-mentioned surfactants seem ideal potential candidates in making nanomaterial, it is also necessary to consider the stability associated with the colloidal solution. Since our experiment uses centrifuge, it is also necessary to consider the amount of surfactant which will be suspended upon centrifugation. Thus, there are many factors which play a heavy hand in choosing surfactants.

The other way to optimize the process is to introduce an extra component which can enhance and act as symbiotic with the currently used surfactant, CTAB. The combined surfactant is called as “Binary Surfactant”.

The primary surfactant used to synthesize gold nanorods (GNR) is CTAB. But to synthesize high amounts of GNR, high concentration of CTAB is required. But CTAB, which acts as soft template here, is not considered as its primary role. Thus, it is necessary to optimize the surfactant to produce still more amount of GNR and different dimensionalities with less amount of CTAB. To optimize CTAB, Binary Surfactant is introduced in the production of GNR. The other role of Binary Surfactant is to reduce the amount of impurities produced in the solution, apart from getting different geometrical sizes.

CTAB along with Sodium Oleate (NaOL) is considered as binary surfactant mixture. Here CTAB is cationic and NaOL is anionic surfactant. Since both the components are opposite in nature, increasing one’s concentration will have deep impact in the size of the NR, like length and diameter of the NR. Here, if the concertation of CTAB is increased keeping the other parameters constant, dimeter of NR gets smaller. And the opposite also holds true.

To conclude, binary surfactant is better in synthesizing nanomaterial, compared to introducing a new component and leaving CTAB behind. We have already used CTAB in our experiment and also determined that it helped in synthesizing TiB_2 nanorods. It is now time to introduce new surfactant like NaOL which does not react with H_2O_2, but when combined with CTAB provides higher yield.

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