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Optimization of curcumin method in determination of boron in steelandusage of natural curcumin in the analysis

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Boron containing alloy steels are mainly used in constructional, automotive and many other applications. The presence of even trace amounts of boron greatly affect the properties of steel. The major function of boron is to increase the hardness of steel and also it gives a better machinability compared with boron-free steel.

As traces of boron affect the properties of steel, it is important to determine it accurately and precisely in the manufacture of these alloys. Due to the drawbacks of common advanced techniques such as Atomic Absorption Spectroscopy or Inductively Coupled Plasma-Atomic Emission Spectroscopy, the universally accepted most sensitive and accurate method for determination of boron in steel is the spectrophotometric method using curcumin as an auxillary agent.

This method is very time consuming and laborious. Although curcumin is the most sensitive spectrophotometric reagent for the above analysis, synthetic curcumin is relatively expensive, and degrades readily when exposed to the atmosphere. This study was carried out to improve and optimize the existing spectroscopic method. In it, several steps of the existing method were altered or skipped and then the recovery of boron was compared with the existing method. As the second part of the study, curcumin was extracted from turmeric and the possibility of using natural curcumin in the analysis was determined.

The results implied that natural curcumin can be used as accurately and precisely as synthetic curcumin in the analysis. A boron-steel alloy sample found to be containing 0.26±0.01 percent of boron with synthetic curcumin gave an amount of 0.25±0.00 percent of boron with natural curcumin, indicating no significant difference in the determination. A steel sample found to be containing 0.27±0.01 percent of boron with the filter paper ashing step gave an amount of 0.26±0.01 percent of boron without the filter paper ashing step indicating that the ashing step of the existing method can be skipped. Altering the distillation step of existing procedure significantly changed the recovery of boron indicating that the distillation step cannot be optimized further.

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