Review Article

GREEN ANALYTICAL CHEMISTRY : A REVIEW OF ECO-FRIENDLY TECHNIQUES

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Green analytical chemistry (GAC) is developing quickly at the moment, necessitating the establishment of clear, succinct guidance in the form of GAC principles that will aid in greening laboratory operations. Because they fall short of analytical chemistry's requirements, the current green chemistry and green engineering principles need to be revised for application in GAC. This article presents a collection of principles that will be crucial for GAC's future. These principles include some innovative ideas (like using natural reagents) as well as well-known ones (like reducing the use of energy and reagents and eliminating waste, risk, and hazard). The goal of green analytical chemistry is to make analytical processes safer for people and the environment. When evaluating the greenness of an analytical approach, a wide range of factors are taken into account, including the quantity and toxicity of reagents, waste generated, energy consumption, the number of procedural steps, miniaturization, and automation. The eco-scale assessment (ESA), the green analytical procedure index (GAPI), and the national environmental methods index (NEMI) are the three evaluation techniques. Generally, GAC serves as a catalyst for advancing analytical chemistry. The primary challenge of GAC is to balance the reduction of the adverse effects of analytical procedures on the environment with the improvement of the quality of analysis results. Analytical laboratories generate substantial amounts of chemical waste due to extensive solvent use, sample preparation procedures, and energy-intensive instrumentation. Techniques such as chromatography and spectrometry often rely on toxic organic solvents and produce hazardous residues. With increasing global awareness of environmental sustainability and stricter regulatory policies, the need for greener analytical alternatives has become essential.

Key words: Green Chemistry, Eco scale assessment, Energy efficiency, Hazard reduction, NEMI

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