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A Review on Application of GC-MS in Textiles

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Abstract
The GC-MS is a modern and sophisticated technique to separate all components with the corresponding mass of any mixture. This technique is widely applicable in textiles. This technique was successfully used to analyze synthetic dyestuff, residual pesticide, and natural dye and flame retardants. This technique can be used to monitor pollution level contributed by textile effluent.

Keywords： GC-MS, Sophisticated Technique, Dye Analysis, Flame Retardant, Pollution**.**

1. Introduction

The GC-MS is a sophisticated technique to separate components from a mixture and determine the mass of all components. This is applicable to analyze all samples of textiles and of other disciplines such as environmental, chemical, pharmaceutical and agricultural sciences [1]. The working principle of GC is separation of individual components by heating using a column with an inert gas like helium. After septation of components, mass of all analyte molecules is determined by mass spectrophotometer known as mass spectrum.

Figure 1. Image of GC-MS Spectrophotometer.

Source: https://en.wikipedia.org/wiki/Gas_chromatography%E2%80%93mass_spectrometry

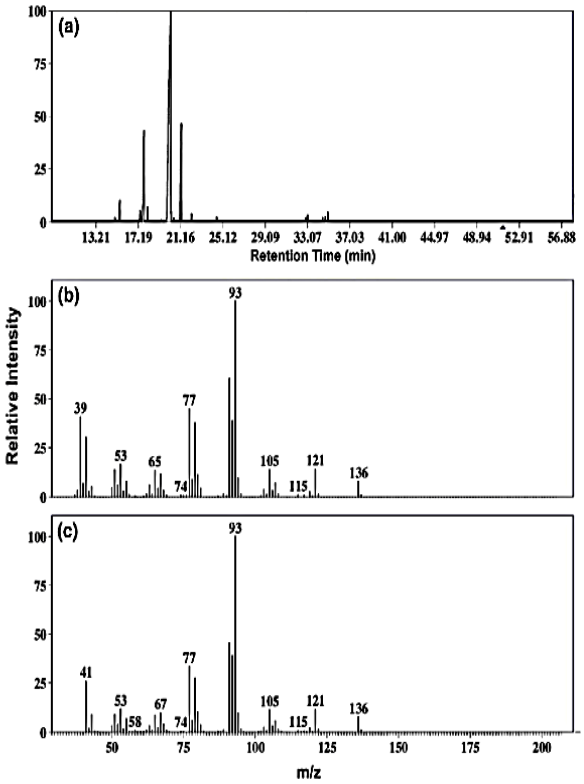

Figure 2. GC-MS Spectrum of Peel Essential Oil.

Source: https://www.researchgate.net/figure/Typical-GC-MS-total-ion-chromatogram-TIC-and-

mass-spectrum-of-peel-essential-oil-from_fig1_272376064

The GC-MS spectrum is widely used in textiles [2]. This review article covers a comprehensive literature survey related to application of GC-MS in various fields of textiles.

2. Discussion

Juan et al. [2], reported a significant GC-MS method for determination of short-chain chlorinated paraffin used in textiles. These paraffin, are a combination of polychlorinated n-alkanes. These compounds are used as flame retardants for textile. These compounds have become an environmental issue because of toxicity and bioaccumulation. The existing analytical equipment set-up is very expensive and requires a lot of space and advanced skills for operation. Another commercially available method is operation with GC-MS requires short duration with satisfactory sensitivity. Authors explained that, in the above ultrasonic extraction was done with n-hexan e followed by GC-MS identification using external standard.

In another report, Ahn reported application of GC-MS to examine berberine dye [3]. Author explained that berberine was examined by GC-MS for selection of figure print products which was applicable to identify this dye in archeological textiles [3]. Wang et al. reported a GC-MS based method to measure the content of residual form of cholorothalonin in textiles [4]. In this work, chlorothalonil was extracted by using ultrasonic method. Ethyl acetate was used as solvent for extraction. External standard method was applied for calibration.

Pesticides are used in cotton production and storage. For this reason, assurance of safe use of clothing is essential. Hrouzkova et al. reported a modified procedure to isolate residual pesticide from textile samples by using the GC-MS technique [5]. In this report, authors explained isolation method of 33 pesticides including organochlorine, triazines and others. The beauty of this technique was requirement of minimal sample and consumption of solvent.

GC-MS is a suitable technique for identification of natural indigo in historical textiles. Authors discussed that, this method is applicable to identify all unknown dyes and in historical textile products [6]. This method includes high separation efficiency. The reproducibility of results is also in acceptable limit. The natural products like, flavonoids ca be identified in one step.

Several synthetic fibers are emitted such as polyethylene terephthalate and nylon-6 during laundering process in textiles [7]. These microfibers can be quantified by GC-MS technique efficiently.

Monitoring of textile wastewater treatment is possible by using GC-MS technique. Weschenfelder et al. reported this technique was applicable to follow up pollutants in wastewater [8].

GC-MS technique is widely applicable to analyze flame retardants in textiles [9].

This technique is suitable to analyze natural dye useable in textiles. Authors explained GC-MS analytical technique to characterize natural dye isolated from turmeric [10].

3. Gap Analysis and Recommendations

It was found that a very limited number of papers were published in various journals in this field. To justify all the research findings, enough reproducibility verification is required. More research works are needed to be done in this field. Following recommendations are proposed for enough knowledge creation in this field,

(a) Excellent research ideas need to be generated,
(b) Based on the ideas experimental plans need to implement,

(c) A few papers were found on characterization of natural products by GC-MS, more papers need to be published and
(d) Coordinated research is essential to improve the application of GC-MS in textiles.

4. Conclusion

GC-MS is a sophisticated technique to find out the mass of any component present in a mixture of textile product. The technique involves separation method called "GC". Gas chromatography is widely used for appropriate separation of each and every component of a product mixture. GC-MS can be used efficiently in the relevant applications of textiles.

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