

P10 DETERMINATION OF THE VOLATILE ORGANIC COMPOUNDS IN PAINTS AND VARNISHES

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Introduction

Some of volatile organic compounds (VOC) are used as paint additives. VOC can react to sunlight, changing to ozone and other pollutants that produce photochemical smog in the lower atmosphere¹. One of the way of VOC minimizing is increasing usage of water-based emulsion paints. Emulsion paints and varnishes consists of emulsion resin incorporated with hydrophilic polymer, ion group or emulsifier. Major agents are emulsified organic or inorganic binders. Water-based emulsion paints do not contain high VOC as solvent paints do. However, these paints include low VOC (e.g. glycols), which are long-lasting released into air environment in small concentrations, what is potentially dangerous to human beings. Thus, it is necessary to monitor composition of paints as prevention from health-damage. The aim of this work is to determine VOC in water-based varnishes using gas-chromatography system.

Experimental

The model emulsion paint for testing of in-can VOC analysis was prepared by dilution of the water-dispersion of copolymer of styrene with acrylic acid esters, 78.2 % (Mowilith 7460), with 16.6 % of water and than by mixing of the diluted dispersion with coalescents, as shown in Table1.

The VOC in a very small amount (15±3 mg) were heated at 150 °C for 4 min. in a septum-sealed vial, after full evaporation, vapour phase was transferred to non-polar capillary column, then determined by gas-chromatographic analysis. Standard volumes of stock mixture were added at four concentration levels (10, 20, 30, 40 µl) to obtain the



Fig. 1. Representative gas-chromatogram of the sample with standard addition of 40 µl of the stock reference compound mixture

VOC content. Stock mixture consisted of 1 g of each reference compounds (each coalescent and tetradecane as final marker). Each standard addition was added to 10 g of original sample and shaken well. At least five analyses were made of each concentration level.

GC-MS measurement of VOC from paints were made with Hewlett-Packard GC-MS apparatus GC-MSD 5890A/5790B, equipped with gas chromatograph (model HP 5890) and mass spectrometer (model HP 5970B). Supelco fused-silica capillary GC column PTE-5 (30 m × 0.25 mm i.d.) with a SE-54-type phase coating (0.25 µm) was used. The injector temperature was 250 °C and the temperature of transfer line was 275 °C. The GC oven temperature program: 3 min. at 35 °C, increased at 10 °C min⁻¹ to 100 °C, then increased at 15 °C min⁻¹ to 250 °C. Analyses were performed in splitless mode. Helium was used as the carrier gas. Mass spectrometer detector temperature was set to 275 °C, scan range 42–250 amu, threshold 1500, the electron energy 70 eV, scan 2.06 scan sec⁻¹, solvent delay was 3 min. The identification of separated components – mass spectra were interpreted with the help of mass spectra library databases.

Results and discussion

Although the water-based paints and varnishes are proclaimed as non-harmful for human health, it is necessary to analyse the constitution declared by producers from the point of view of VOC. The accurate volatilization mechanism of glycols used as coalescents and released from EPs for many years in small concentrations is not well-known up to present.

Fig. 1. shows typical GC-chromatogram, recorded under above-described experimental conditions. The method of standard additions was used to correlate and quantify the content of individual components, present in samples. The quantitative analysis was carried out as follows: the area of chromatogram peak was related to 1 mg of the sample weight. The average values for identical components were calculated for each volume of sample. Linear regression analysis was carried out, as depicted in Fig. 2., where the dependence of average area on the volume of the stock reference compound mixture is shown. The so-obtained calibra-



Fig. 2. Linear regression analysis shows dependence of average area on the volume of the stock reference compound mixture for 1,2-propanediol

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Table of Contents Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products

1. Understanding the eBook Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - The Rise of Digital Reading Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Advantages of eBooks Over Traditional Books
2. Identifying Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - User-Friendly Interface
4. Exploring eBook Recommendations from Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Personalized Recommendations
 - Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products User

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6. Navigating Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products eBook Formats

- ePub, PDF, MOBI, and More
- Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products Compatibility with Devices
- Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products Enhanced eBook Features

7. Enhancing Your Reading Experience

- Adjustable Fonts and Text Sizes of Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
- Highlighting and Note-Taking Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
- Interactive Elements Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products

8. Staying Engaged with Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products

- Joining Online Reading Communities
- Participating in Virtual Book Clubs
- Following Authors and Publishers Manual On Determination Of Volatile Organic Compounds In Paints Inks And

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9. Balancing eBooks and Physical Books Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Setting Reading Goals Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Fact-Checking eBook Content of Manual On Determination Of Volatile Organic Compounds In Paints Inks And Related Coating Products
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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