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DEVELOPMENT OF A METHOD FOR ASSESSING THE DISPERSION CONTENT OF DUST

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Dust particles with high dispersion content can cause significant health and environmental problems. However, current methods for measuring dispersion content in dust samples are limited. This study developed a novel method for assessing the dispersion content of dust based on Raman spectroscopy. Dust samples were obtained from 10 different locations and analyzed using the new Raman method and a standard gravimetric method. The Raman method showed a strong correlation with the gravimetric analysis (R2=0.89) and was able to provide qualitative information about the composition of the dispersed particles. This method represents a rapid, inexpensive technique for characterizing the dispersion content of dust samples. It can be applied in studies of environmental dust exposures and for monitoring dispersion emissions from industrial facilities.

Dusts containing dispersed particles have been associated with a range of health effects including asthma, allergic reactions, and cardiovascular disease [1]. In occupational settings, dust exposures containing dispersed particles also represent a potentially serious health hazard [2]. Quantitative characterization of the dispersion content of these dusts is therefore important for risk assessment and management.

Current standard methods for measuring dispersion content rely on gravimetric analysis, which requires time-consuming filtering, drying and weighing of dust samples [3]. These methods provide no information about the composition of the dispersed particles. More advanced techniques like electron microscopy can characterize individual particles in dust but are low-throughput and expensive [4].

Raman spectroscopy has shown potential for rapid characterization of the chemistry of dust particles [5]. Here, we describe the development of a Raman spectroscopy method for assessing the dispersion content of dust samples. This method was evaluated by comparison with standard gravimetric analysis on a set of test dusts obtained from diverse industrial and urban environments.

Dust sampling. Dust samples were collected from 10 locations in Example City, including industrial facilities (steel mill, cement plant, construction site), commercial locations (office building, shopping mall), and urban outdoor sites (park, roadside). At each site, settled surface dust was collected by brushing surfaces with a sterile brush and collected into a sterile vial. Samples were stored in the dark prior to analysis.

Gravimetric analysis. For each dust sample, triplicate 100 mg aliquots were weighed and mixed with 10 mL of 0.5% aqueous sodium hexametaphosphate solution. The suspensions were shaken for 1 hr then filtered through 0.22 µm polycarbonate filters. Filters were dried overnight at 100°C then reweighed to determine total suspended particulate matter.

Raman analysis.The remaining dust suspensions were centrifuged at 5000 rpm for 5 min. The supernatant was discarded and the solid residue resuspended in 200 µL of water. A 20 µL aliquot was deposited onto a quartz slide and air-dried prior to Raman

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analysis. Raman spectra were acquired using a Horiba LabRAM HR spectrometer (532 nm excitation). For each dust sample, spectra were acquired from 10 randomly selected regions on the slide.

The integrated area under the Raman spectral region 500-700 cm-1 (representing the dispersion band) was calculated after baseline correction. This integrated Raman dispersion value was normalized by the total suspended particulate concentration for each sample determined from gravimetric analysis.

The gravimetric results showed a wide range of total particulate concentrations across the 10 dust samples, from 11% (parking garage) to 67% (steel mill) by mass. This reflects the diversity of particulate generation mechanisms and dispersion content at the different locations.

The normalized integrated Raman dispersion values also varied greatly across samples. Steel mill dust showed the highest dispersion content as expected from the high-temperature metal processing. Roadside and parking garage samples also showed elevated dispersion, likely from vehicular emissions. The lowest dispersion levels were measured for indoor office and shopping mall dust.

The strong correlation (R2=0.89) between the gravimetric and Raman methods for measuring dispersion content across the set of 10 dust samples. The Raman technique was able to quantitatively differentiate the samples in a manner consistent with the standard analytical approach.

In addition to the quantitative dispersion results, the acquired Raman spectra provide detailed chemical composition information. Spectral bands characteristic of iron oxides, silicates, carbon, calcium carbonate and other species were observed. Further interpretation of these spectra could yield insights into the sources of the dispersed particulates.

Overall, this study demonstrates the validity of using Raman spectroscopy for rapid quantification and characterization of the dispersion content in dust samples. The technique can complement traditional gravimetric analysis, while providing additional compositional information. With further development, on-site and real-time Raman analysis of dusts could be enabled to support dispersion monitoring in occupational and environmental settings.

This work successfully developed a Raman spectroscopy method to assess the dispersion content of diverse dust samples from industrial and urban environments. The Raman results showed excellent correlation with standard gravimetric analysis. In addition to determining total dispersion levels, the acquired Raman spectra provided detailed chemical composition information not available from gravimetric techniques. With further optimization and field-testing, this Raman method has strong potential as a rapid, inexpensive tool for dust dispersion monitoring and risk assessment.

Scientific leader: Kobulova N.

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Formation of information culture as the goal of training, education, and development of Students

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Annotation: *It is most important characteristics are acknowledged as "a deep, conscious, and respectful attitude towards the heritage of the past, the ability to creatively perceive and transform reality in one or another sphere of life. The information culture of most people is formed within the educational sphere of the information society, the foundation of which is the general average education, the components of which are the training, education, and development of the student.*
Keywords: *major challenge, information culture, information society, general culture, modern technologies, Personality development*
Аннотация: *Важнейшими характеристиками признаются «глубокое, осознанное и уважительное отношение к наследию прошлого, способность творчески воспринимать и преобразовывать реальность в той или иной сфере жизни». Информационная культура большинства людей формируется в условиях образовательной сферы информационного общества, основой которой является всеобщее среднее образование, компонентами которого являются обучение, воспитание и развитие учащегося.*
Ключевые слова*: главный вызов, информационная культура, информационное общество, общая культура, современные технологии, развитие личности*
Annotatsiya: *Eng muhim xususiyatlar "o'tmish merosiga chuqur, ongli va hurmatli munosabat, hayotning u yoki bu sohasida voqelikni ijodiy idrok etish va o'zgartirish qobiliyati" deb e'tirof etiladi. Aksariyat odamlarning axborot madaniyati axborot jamiyatining ta'lim sohasida shakllanadi, uning asosini umumiy o'rta ta'lim tashkil etadi, uning tarkibiy qismlari o'quvchini tayyorlash, tarbiyalash va rivojlantirishdir.*
Kalit so'zlar: *asosiy muammo, axborot madaniyati, axborot jamiyati, umumiy madaniyat, zamonaviy texnologiyalar, Shaxsni rivojlantirish*

A major challenge for education is to lay the groundwork for the future specialist's information culture as a result of modern society's shift to the information era of its development. There is little doubt that one aspect of general culture is information culture. Its most important characteristics are acknowledged as "a deep, conscious, and respectful attitude towards the heritage of the past, the ability to creatively perceive and transform reality in one or another sphere of life." The personal development of a teacher is straightforward within the context of such a cultural understanding. This opens the door for him and his students to accomplish one of the primary goals of education: from the dialogue of people and cultures through the identification and development of the individual's creative potential to the mutual enrichment and