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Молодой учёный. 2016 г. № 6, 346 с.
6. Ниязов Х., Курбанов Ж., Хаитбаев А.Х., Мухаммедов Г.И. Приобретение межполимерных композитов по акциям. Информационный бюллетень FarDU. Ф. 2017 г. № 2. 13 б.
7. Ахмедов М. А., Атакузиев Т. А. Фосфогипс. Исследования и применение. Ташкент: изд-во «ФАН» Узб.ССР, 1980 - 155 с.

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PHYSICOCHEMICAL PROPERTIES OF UREA FORMALDEHYDE OLIGOMER

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Abstract. The paper shows the use of a new type of highly efficient, cheap polymer-phosphogypsum complexes based on polymerpolymer complex and wastefrom the chemical industry of phosphogypsum with a high degree of softening up to0.86-0.96. From the point of view of laboratory experiments, it can be said that thepolymer phosphogypsum complex has the best characteristics. Thus, the proposedmethods are promising and can be used as chemical meliorants to improve thestructure of the soil.
Key words: polymer-polymer complex, chemical industry, polymer-phosphogypsum, chemical meliorant.

The physicochemical properties of urea-formaldehyde oligomers play a crucial role in determining their suitability for diverse industrial applications. These properties include:

Molecular Weight and Degree of Polymerization: Urea-formaldehyde oligomers exhibit a range of molecular weights and degrees of polymerization, which directly impact their viscosity, reactivity, and mechanical properties. Higher molecular weight oligomers tend to have greater crosslinking densities and improved mechanical strength, making them suitable for applications requiring high durability, such as in wood adhesives for furniture and construction materials.

Crosslinking Density: The extent of crosslinking within urea-formaldehyde oligomers influences their thermal stability, water resistance, and dimensional stability. Oligomers with higher crosslinking densities exhibit superior resistance to heat, moisture, and dimensional changes, making them ideal for applications in exterior coatings, laminates, and molded products. [1].

Curing Characteristics: The curing behavior of urea-formaldehyde oligomers, including their curing time, temperature requirements, and cure kinetics, significantly impacts their processability and final properties. Controlling the curing parameters allows manufacturers to tailor the properties of urea-formaldehyde oligomers for specific applications, such as fast-curing adhesives for assembly lines or slow-curing resins for intricate molding processes.

Thermal and Chemical Stability: The thermal and chemical stability of urea-formaldehyde oligomers determine their resistance to degradation under harsh environmental conditions, such as exposure to high temperatures, UV radiation, and chemical agents. Oligomers with enhanced stability are favored for applications requiring long-term performance, such as in automotive coatings, electrical insulators, and aerospace components. [2].

Rheological Properties: The rheological behavior of urea-formaldehyde oligomers, including their viscosity, flow characteristics, and thixotropic properties, influences their processability during manufacturing and application. Optimal rheological properties

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ensure uniform coating deposition, efficient adhesive bonding, and easy handling of composite materials, thus enhancing productivity and product quality in various industries. [1].

Overall, the physicochemical properties of urea-formaldehyde oligomers dictate their performance and versatility across a wide range of industrial applications, including adhesives, coatings, composites, and molded products. Understanding and optimizing these properties enable the development of tailored formulations to meet specific performance requirements and address evolving market demands.Factors such as molecular weight, degree of polymerization, and crosslinking density significantly influence the physicochemical properties of urea-formaldehyde oligomers, impacting their suitability for various applications. Here's how these factors affect the properties and how they are experimentally characterized: [3].

1. Molecular Weight and Degree of Polymerization:

Effect: Higher molecular weight and degree of polymerization typically result in increased viscosity, improved mechanical strength, and enhanced thermal stability. These properties are crucial for applications requiring high durability and dimensional stability.

Experimental Characterization: Molecular weight and degree of polymerization can be determined using techniques such as gel permeation chromatography (GPC), size exclusion chromatography (SEC), or viscometry. These methods analyze the distribution of molecular sizes within the oligomer sample, providing insights into its overall molecular weight and polymerization degree.

2. Crosslinking Density:

Effect: Crosslinking density affects the rigidity, thermal stability, and mechanical properties of urea-formaldehyde oligomers. Higher crosslinking densities result in increased stiffness, improved resistance to heat and chemicals, and reduced susceptibility to dimensional changes.

Experimental Characterization: Crosslinking density can be assessed using techniques such as dynamic mechanical analysis (DMA), differential scanning calorimetry (DSC), or swelling tests. These methods measure parameters such as storage modulus, glass transition temperature, or solvent uptake, providing information about the extent of crosslinking within the oligomer network. [4-7].

3. Curing Characteristics:

Effect: The curing behavior of urea-formaldehyde oligomers influences their processability, adhesion strength, and final properties. Factors such as curing time, temperature, and cure kinetics determine the speed and efficiency of the curing process, as well as the development of desired mechanical and chemical properties.

Experimental Characterization: Curing characteristics are evaluated using techniques such as differential scanning calorimetry (DSC), Fourier-transform infrared spectroscopy (FTIR), or rheological analysis. These methods monitor changes in temperature, chemical composition, or viscosity during the curing process, allowing researchers to optimize curing conditions for desired performance outcomes.

By understanding and controlling these key factors, researchers and manufacturers can tailor the physicochemical properties of urea-formaldehyde oligomers to meet specific application requirements, ranging from adhesives and coatings to composite materials and molded products. Experimental characterization techniques provide valuable insights into the structure-property relationships of these oligomers, guiding the development of optimized formulations for diverse industrial applications.

Recent advancements in understanding and manipulating the physicochemical properties of urea-formaldehyde (UF) oligomers have led to significant improvements in their performance across various applications, including adhesives, coatings, and composite materials. Here are some of the latest developments:

Tailored Molecular Architectures: Researchers have been exploring novel synthesis routes to tailor the molecular architecture of UF oligomers, aiming to achieve desired properties such as enhanced adhesion, flexibility, and thermal stability. Advanced polymerization techniques, such as controlled/living polymerization and copolymerization, allow for precise control over the molecular structure, enabling the development of oligomers with optimized performance characteristics for specific applications.

Functionalization and Crosslinking Strategies: Functionalizing UF oligomers with reactive groups or additives has emerged as a promising approach to enhance their compatibility with substrates and improve their adhesion and mechanical properties. Additionally, innovative crosslinking strategies, such as incorporation of multi-functional crosslinkers or nanofillers, enable the formation of highly crosslinked networks with improved durability, chemical resistance, and thermal stability, making them suitable for demanding applications in harsh environments.

Green Chemistry and Sustainable Formulations: With growing concerns about environmental sustainability and health safety, there is increasing interest in developing eco-friendly UF oligomers derived from renewable resources and non-toxic monomers. Green synthesis routes, such as bio-based feedstocks and solvent-free processes, minimize the environmental footprint of UF oligomer production while maintaining or even enhancing their performance attributes. Furthermore, bio-inspired approaches, such as mimicking natural adhesion mechanisms found in marine organisms, offer insights into designing bioadhesive UF oligomers with superior wet adhesion and underwater bonding capabilities.

Advanced Characterization Techniques: The advent of advanced characterization techniques, such as atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), and solid-state NMR spectroscopy, has enabled researchers to probe the nanoscale structure and interfacial interactions of UF oligomers with substrates or reinforcing agents. These insights into the molecular-level interactions facilitate rational design and optimization of UF-based formulations for specific applications, leading to improved performance and reliability.

Multi-Functional Applications: Expanding the utility of UF oligomers beyond traditional applications, such as adhesives and coatings, researchers are exploring their potential in emerging fields such as 3D printing, advanced composites, and biomedical materials. By leveraging the inherent versatility and tunability of UF oligomers, innovative formulations with tailored properties are being developed to address the evolving needs of diverse industries, ranging from aerospace and automotive to healthcare and electronics.

Overall, the latest advancements in understanding and manipulating the physicochemical properties of UF oligomers are driving innovation and unlocking new opportunities for their utilization across a wide spectrum of applications. Through interdisciplinary research efforts and collaborative partnerships, scientists and engineers are poised to continue pushing the boundaries of UF oligomer technology, paving the way for sustainable, high-performance materials with unprecedented capabilities.

LIST OF REFERENCES

1. Ахмедов А.М. Физико-химические свойства интерполимерных композиционных материалов// "Экономика и социум" 2023. №6(109).

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