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Джумабаева Сахра, Сердарова Айджемал ПРЕДИКАТИВНАЯ СИНТАКСИЧЕСКАЯ СВЯЗЬ	66
Какамурадова Дженнет НЕВРИТ ЛИЦЕВОГО НЕРВА	70
Какамурадова Дженнет ДЕМИЕЛИНИЗАЦИЯ	76
Какамурадова Дженнет СИРИНГОМИЕЛИЯ	85
Какамурадова Дженнет СИНДРОМ МАРФАНА	90
Какамурадова Дженнет, Байраммухаммет Байханов ВЕГЕТАТИВНО-СОСУДИСТАЯ ДИСТОНИЯ	95
Какамурадова Дженнет, Дурдиева Гозель СИНДРОМ ГИЙЕНА-БАРРЕ (СГБ)	98
Дурдиева Гозель СИНДРОМ ПОТТЕРА	104
Дурдиева Гозель МЕНИНГИТ	110
Пирмухаммедов Арслан АЛГОРИТМ ДИАГНОСТИКИ КРИПТОГЕННОГО ИНСУЛЬТА У МОЛОДЫХ	113
Пирмухаммедов Арслан ОСОБЕННОСТИ ПОСТЕПЕННОГО ТЕЧЕНИЯ ИНСУЛЬТА У МОЛОДЫХ	116
Сахетдурдыев Какамурат НЕЙТРАЛИТЕТ ТУРКМЕНИСТАНА: БЛАГОРОДНЫЙ ПРИНЦИП МИРА И ДРУЖБЫ	119
Ekayev Mukam, Berdiyeva Ayjemal, Suhanberdiyeva Gozel INTRODUCTION OF THE IMPACT OF GREEN CHEMISTRY ON SUSTAINABLE INDUSTRIAL PRACTICES	123
Ekayev Mukam, Berdiyeva Ayjemal, Alasayev Davut QUANTUM DOTS WITH IMPROVED QUANTUM YIELD	127
Ekayev Mukam, Matkarimova Gulnaza, Babageldiyev Chopangeldi FRIENDLY MATERIALS, SMART COMPOSITES AND HIGH-PERFORMANCE OPTIONS	132
Ekayev Mukam, Berdiyeva Ayjemal, Nazzyyeva Leyla TECHNOLOGY OF PRODUCTION OF CELLULAR SILICATE PRODUCTS	136
Ekayev Mukam, Berdiyeva Ayjemal, Mamishova Aylar TECHNOLOGY FOR PRODUCING GYPSUM USED IN CONSTRUCTION	140
Ekayev Mukam, Nuriyeva Chinar, Ernyyazova Kumush TECHNOLOGY OF PRODUCTION OF DEMULSIFIERS FOR REMOVAL OF WATER FROM OIL	144

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Название публикации: «TECHNOLOGY OF PRODUCTION OF DEMULSIFIERS FOR REMOVAL OF WATER FROM OIL»

Abstract:

This paper explores the technology involved in the production of demulsifiers—chemical agents used to separate water from crude oil emulsions. The study emphasizes the chemistry of emulsion breaking, the classification and formulation of demulsifiers, modern industrial methods of synthesis, and their application in oil processing facilities. The economic and environmental implications are also discussed, with reference to recent innovations in green chemistry.

1. Introduction

Crude oil extracted from reservoirs often contains significant quantities of water in the form of stable emulsions. These water-in-oil (W/O) emulsions pose operational challenges, leading to corrosion, reduced efficiency in downstream refining, and environmental issues. The use of demulsifiers is essential to efficiently separate water from crude oil, thus improving processing efficiency and crude quality.

2. Fundamentals of Emulsion and Demulsification

2.1 Nature of Oil–Water Emulsions

Crude oil emulsions are typically stabilized by natural surfactants such as asphaltenes and resins. These surface-active agents form rigid interfacial films around water droplets, making physical separation difficult.

2.2 Demulsification Mechanism

Demulsifiers reduce interfacial tension, displace natural emulsifying agents, and coalesce water droplets, allowing gravitational separation. The most effective demulsifiers are amphiphilic molecules with both hydrophilic and lipophilic segments.

3. Types and Composition of Demulsifiers

3.1 Classification

Nonionic demulsifiers: Based on ethoxylated resins, polyethers.

Cationic and anionic demulsifiers: Less commonly used due to corrosiveness.

Hybrid systems: Combine properties of multiple agents for enhanced performance.

3.2 Key Components

Polyethylene glycols

Poly(propylene oxide)

Resin alkoxylates

Fatty alcohols and amines

4. Production Technology of Demulsifiers

4.1 Synthesis Processes

The production generally involves alkoxylation reactions, often catalyzed by alkali metals or Lewis acids. For example:

R-OH+n(CH2$CH2O$)→R-(OCH2$CH2$)n-OH

R-OH+n(CH 2CH 2 O)→R-(OCH 2CH 2) n-OH

4.2 Industrial Methods

Batch processing in stirred tank reactors

Continuous flow reactors for large-scale alkoxylation

Use of solvents like toluene or xylene depending on the target hydrophilic-lipophilic balance (HLB)

4.3 Quality Control

Important properties include:

Cloud point

Pour point

Interfacial tension (IFT) reduction

Water-separation efficiency (Bottle test)

5. Application and Optimization

Demulsifiers are typically injected into crude pipelines or settling tanks at dosages ranging from 50 to 500 ppm. Optimization depends on:

Crude composition

Emulsion pH and temperature

Residence time in separators

Field testing using bottle tests and on-site adjustments are common for best performance.

6. Environmental and Economic Considerations

Environmental impacts include toxicity of non-biodegradable compounds and volatile organic compound (VOC) emissions. Current trends favor the development of green demulsifiers based on:

Biodegradable polymers

Renewable feedstocks (e.g., lignin, polysaccharides)

Water-based formulations

Cost-efficiency and ease of application also drive research in demulsifier technology.

7. Recent Advances and Research Trends

Recent developments include:

Nano-demulsifiers with improved surface activity

Smart demulsifiers responsive to pH or temperature changes

Machine learning models for formulation optimization

8. Conclusion

The production and application of demulsifiers remain critical in the petroleum industry for efficient crude processing. Technological advances are driving improvements in performance, environmental safety, and production economics. Future research aims at sustainable, high-performance solutions for demulsification challenges.

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