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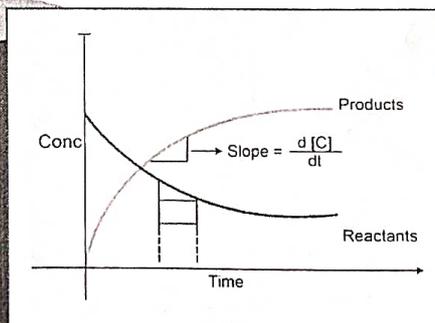
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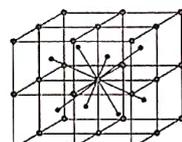
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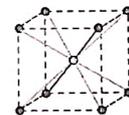
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(a) Space lattice of CsCl



(b) Unit cell of CsCl

Caesium Chloride Structure (bcc)



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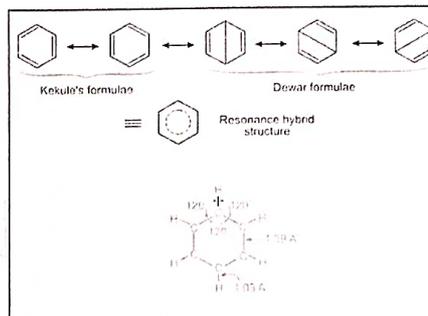
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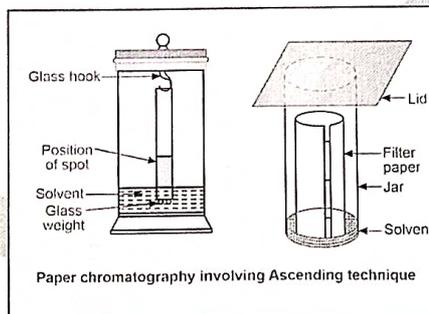
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Advances in Metal Oxides and Their Composites for Emerging Applications

Metal Oxides

2022, Pages 549-599

16 - Metal oxide nanocomposites: design and use in antimicrobial coatings

Vijay S. Ghodake¹, Shamkumar P. Deshmukh^{1,2}, Sagar D. Delekar¹

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Abstract

Similar to the pandemic COVID-19 situations, the world has been facing various infections due to innumerable pathogenic microbes in living organisms, which puts many challenges in front of policymakers, scientists, and governments as well. Among the different strategies to control infection-causing agents, the demand to develop biostatic or biocidal coatings is increasing dramatically. In addition, numerous companies have been marketing the various antimicrobial ways for inactivating or reducing infectious microbes. Among the different types of antimicrobial coatings, surface coating is one of the promising strategies to disinfect the surfaces of various objects or tools used in hospitals, homes, etc. In comparison to organic- or polymer-based agents, metal oxide nanocomposites have been emerged as antimicrobial materials because of their overriding advantages such as higher surface area, excellent stability, non-toxicity, reasonable cost, chemical inertness, etc., which leads to higher activity toward the microbes. Activation through reactive oxygen species generation, ease penetration, well integrity, etc. With these objectives, this chapter discusses the metal oxide nanocomposites-based antimicrobial coatings for controlling the microbes observed on the surfaces of objects used in different sectors, such as hospitals, paints, automobiles, food, etc. Accordingly, this chapter describes the basics of nanocomposites, antimicrobial coatings, characterizing composites, biological measurements for antimicrobial coatings used in various fields up to the future perspectives of nanocomposites-based antimicrobial coatings. Therefore, metal oxide nanocomposites-based antimicrobial coatings can be used effectively to control the microbial proliferation of various objects, devices used in common places of high-risk infections.

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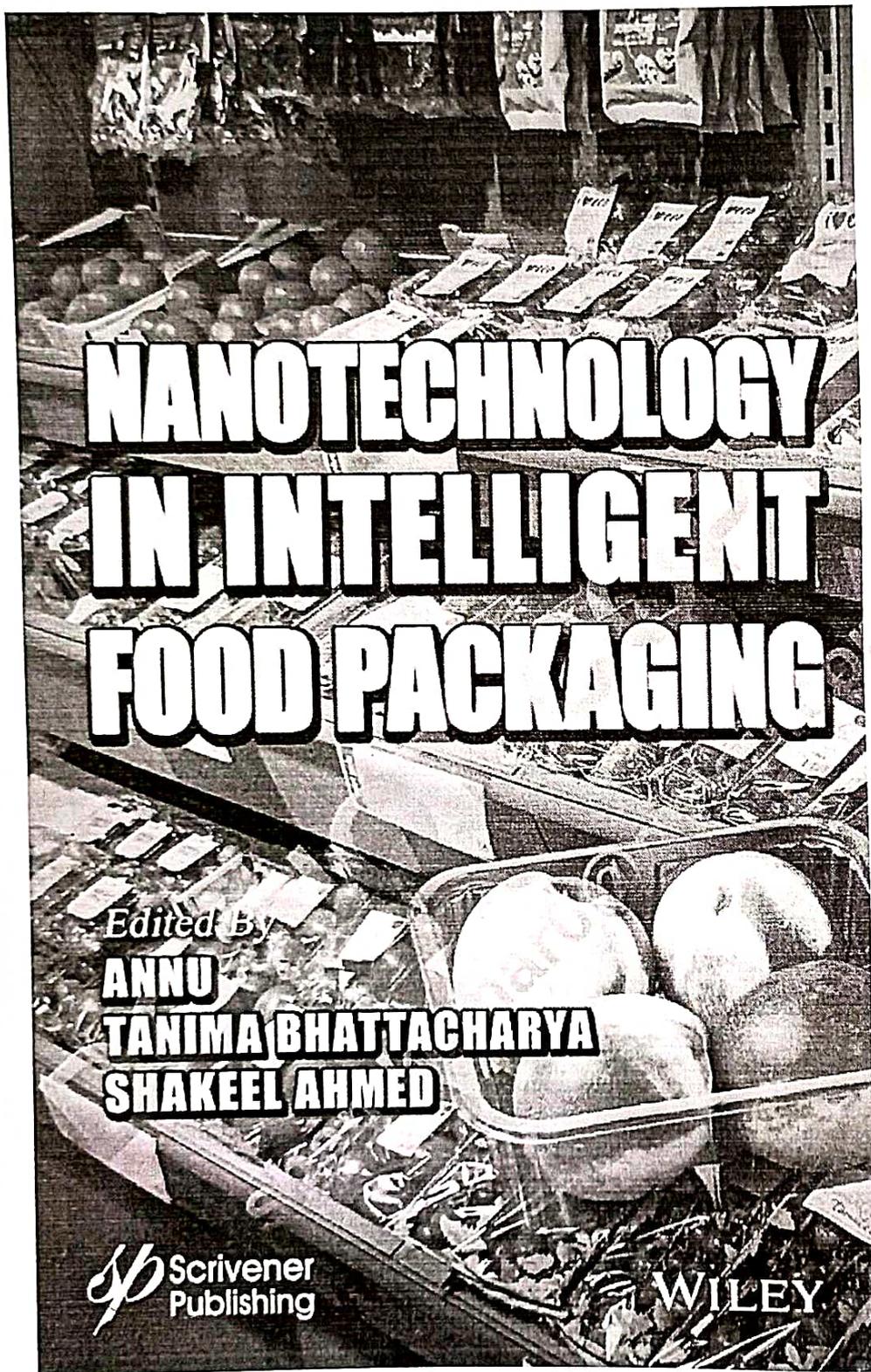
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16.1 Introduction

According to WHO, infectious disease is one of the leading causes of different pandemics and epidemic disease outbreaks like COVID-19, Ebola virus, Chikungunya, Yellow fever, Cholera, etc., because of a variety of pathogenic microorganisms. As an example of COVID-19 infections, more than nine crore people are suffering from coronavirus infections, and hence around two crores of people have been dead in a very short period. As with the COVID-19 infections, the other microbial infections are the most common threats globally, which also would be an ineffective strategy to become a superpower among other countries. Though such microbial infections occur naturally or artificially, it is a question of debate whether ordinary people want to control the microbial infections for an appropriate sustainable life (Mallakpour et al., 2021). In addition, superbugs and mutation of microbes are the challenges for controlling these microbial infections (Geisinger & Isberg, 2017). The center for disease control and prevention reports that around two million people per year are suffering from superbug infections in the USA, and out of which, more than twenty-three thousand patients die annually due to resistant microorganisms (McGuire, 2013). In connection to these challenges, the World Health Assembly and policymakers are inspired to develop the proper solutions for controlling infection-causing microbes. Among the various approaches, the use of efficient antimicrobial agents or their different formulations is the promising one for bacteriostatic or bactericidal strategies. Antimicrobial agents are chemical agents which kill or inhibit the growth of microbes. Based on their composition, these agents are broadly classified as inorganic and organic agents. Basically, organic agents have been utilized as effective materials to inhibit bacteria (Jing et al., 2011). Concerning these agents, β -lactam (like penicillin), cephalosporin or carbapenem, aminoglycosides, and sulfonamides are the commonly used antibiotics for controlling infectious diseases. In the USA, infectious diseases are controlled with limited use of antibiotics, while in developing countries like India, excessive use of antibiotics is the common solution for controlling microbial infections. In addition, organic antiseptic agents like chloroxylenol, triclosan, chlorhexidine, etc. as well as organic disinfectants



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Incorporation of Nanocarriers as Antimicrobial Agents in Food Packaging

Shamkumar P. Deshmukh ✉, Krishna K. Pawar, Dattatray K. Dalavi

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Summary

Food deterioration has become a critical concern in recent years due to the proliferation of bacteria in food and its by-products. Therefore, the shelf life of natural food may be increasing using bioactive antimicrobial agents. In contrast, even though some antimicrobial bioactive compounds are promising, the instability reduces antimicrobial activity. Hence, the search for antimicrobial agents and their crucial physicochemical properties enhances the food's shelf life. In this context, nanocarriers are the vital ingredient for protecting antimicrobial food agents from severe environmental conditions. The bioactive food constituents are avoided from harsh processing and environmental conditions while also allowing them to safely reach their target organs and cells. Therefore, the incorporation of nanocarriers in food as antimicrobials agents is favorable for enhanced antimicrobial activity. The lipid, biopolymer, carriers inspired by nature, carriers based on specialized equipment, metal, and non-metal-based nanomaterials are effective antimicrobial agents in food packaging.

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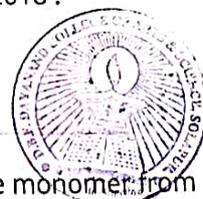
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Incorporation of Nanocarriers as Antimicrobial Agents in Food Packaging

Shamkumar P. Deshmukh^{1*}, Krishna K. Pawar² and Dattatray K. Dalavi³

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Abstract

Food deterioration has become a critical concern in recent years due to the proliferation of bacteria in food and its by-products. Therefore, the shelf life of natural food may be increasing using bioactive antimicrobial agents. In contrast, even though some antimicrobial bioactive compounds are promising, the instability reduces antimicrobial activity. Hence, the search for antimicrobial agents and their crucial physicochemical properties enhances the food's shelf life.

In this context, nanocarriers are the vital ingredient for protecting antimicrobial food agents from severe environmental conditions. The bioactive food constituents are avoided from harsh processing and environmental conditions while also allowing them to safely reach their target organs and cells. Therefore, the incorporation of nanocarriers in food as antimicrobials agents is favorable for enhanced antimicrobial activity. The lipid, biopolymer, carriers inspired by nature, carriers based on specialized equipment, metal, and non-metal-based nanomaterials are effective antimicrobial agents in food packaging.

Keywords: Food packaging, antimicrobial agents, shelf life, nanocarriers, biopolymer, lipid, nanomaterials, bioactive



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Gas Sensors Based on Chalcogenides

[Sharadrao A. Vanalakar](#) , [Shamkumar P. Deshmukh](#) & [Satish M. Patil](#)

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Abstract

The electrical devices like gas sensors are capable of sensing and monitoring the trace amounts of toxicants or gas molecules. It is important in the multiple sectors ranging from the environmental monitoring, individual to social security, and food to national safety. Out of various sensors, the chemoresistive principle-based gas sensors are extensively utilized in practice owing to their simplicity and ease in operation. The oxides are playing prominent role in chemoresistive-type sensors due to their superior gas response, low cost, and simple fabrication. However, issues such as high working temperature, stability,



Chapter 10

Gas Sensors Based on Chalcogenides



Sharadrao A. Vanalakar, Shamkumar P. Deshmukh, and Satish M. Patil

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Keywords Metal chalcogenide · Gas sensor · Sensor response · Oxidizing gas · Reducing gas



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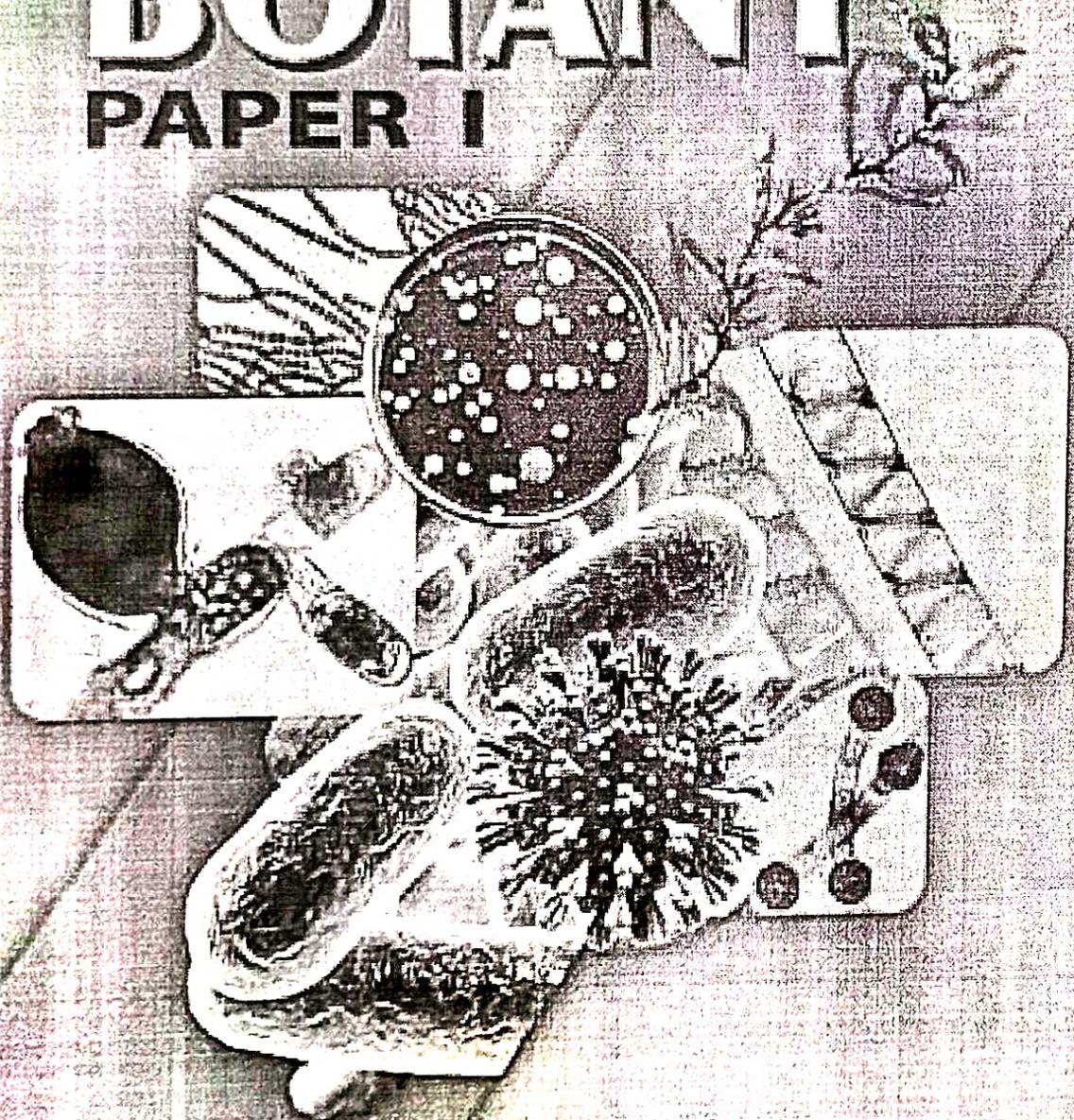
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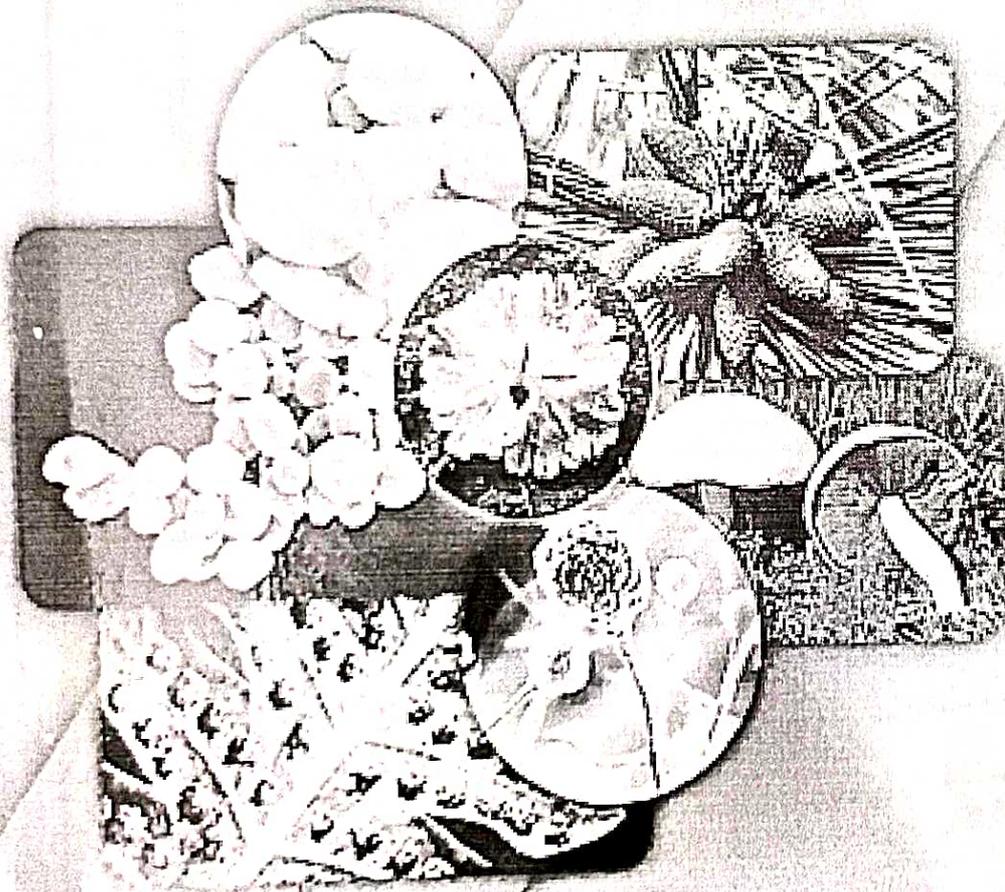
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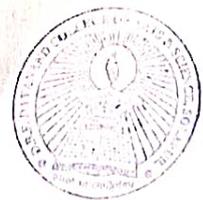


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व्यक्तीवर काव्य करणे किंवा काव्यातून व्यक्तीचे चरित्र उभे करणे हे गद्यचरित्र लेखनाइतके सुबोध नसते. व्यक्तीचे काव्यचरित्र निर्माण करणे हेच मुळात दुर्गम असते.

काव्यातून व्यक्तीचे चरित्रवर्णन करायचे झाल्यास काव्यगुणाच्या परिपोषाकरिता तांत्रिक गुणांचा आधार घ्यावा लागतो. तंत्राचा आधार ही कारागिरी ठरते. कारागिरी दीर्घकाळ टिकत नसते. तिला कलाचे व कलेचे निकषही लावण्याची आवश्यकता उरत नसते. ती आपोआपच प्रभाव ओसरून बसते. व्यक्तीच्या काव्यचरित्रात बाह्यांगापेक्षा आणि अंतरंगातही कवीच्या आतल्या आत आतल्या स्वराचे प्रकटन होत असते. ती कविमनाची अपूर्वता असते. व्यक्ती जगविख्यात असेल, तर अशा व्यक्तीला काव्यरूपातून उभे करणे महत्प्रयास लागतील. भारतीयांसाठी एक अभिमानास्पद बाब म्हणजे, अशा व्यक्ती भारताच्या इतिहासामध्ये आहेत. ज्यांच्या हास्याचे लास्यसौंदर्य निरागसपणा अनुभूतीस देते ते मोहनदास करमचंद गांधी आणि ज्यांच्या धीरगंभीर चेहऱ्यावरील भेदकदृष्टी काही युगांना छेदून काढते ते भीमराव रामजी आंबेडकर यांचे काव्यचरित्र उभे करताना कळत-नकळत ती रचना भाव-काव्याकडे कळत आहे, असे जाणवू लागते. पण कविमन त्या व्यक्तीच्या विचारांनी संपृक्त झालेले असेल, तर मग त्या अंतःस्वरातून विचार झिरपू लागल्याचे जाणवते. अशा स्वरूपाची रचना ‘युगानुयुगे तूच’ हा दीर्घकाव्यात झाल्याची लक्षणे दिसतात. अजय कांडर यांची ही रचना आहे. विशेष म्हणजे अजय कांडर यांनी महात्मा गांधी आणि डॉ. बाबासाहेब आंबेडकर या दोघांवर दीर्घकाव्याची रचना केलेली आहे.

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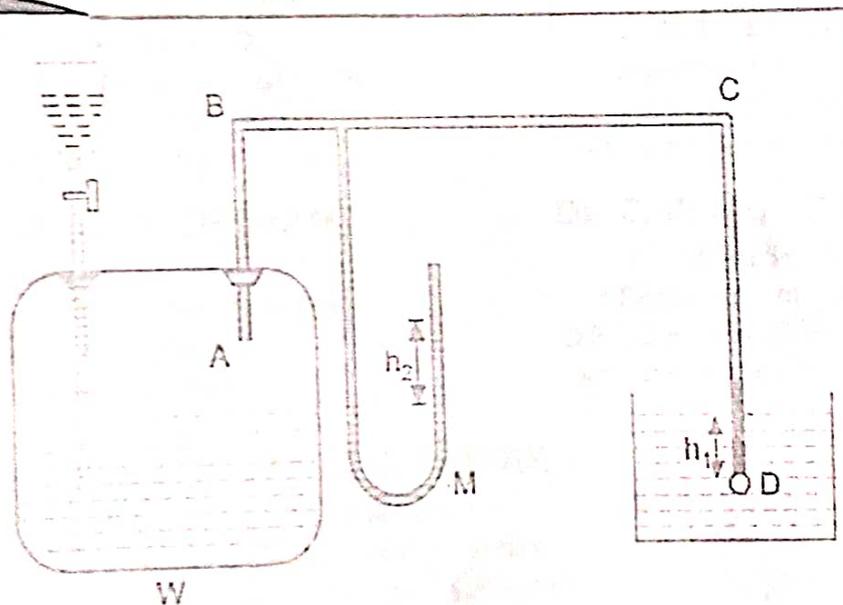
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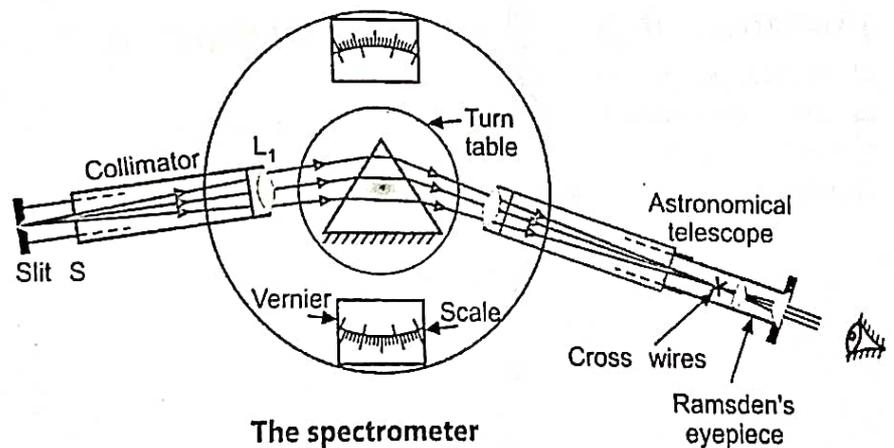
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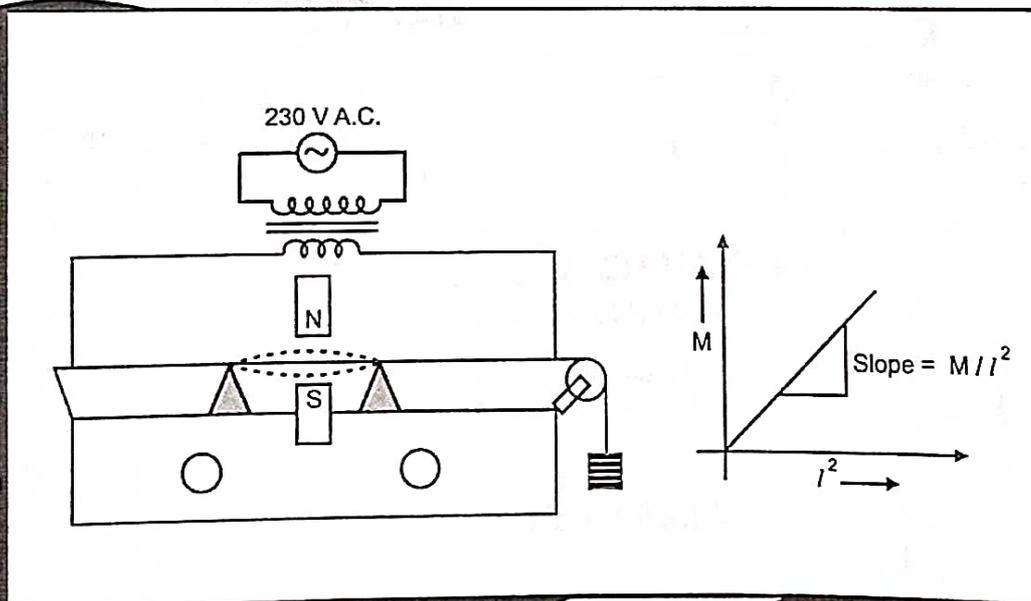
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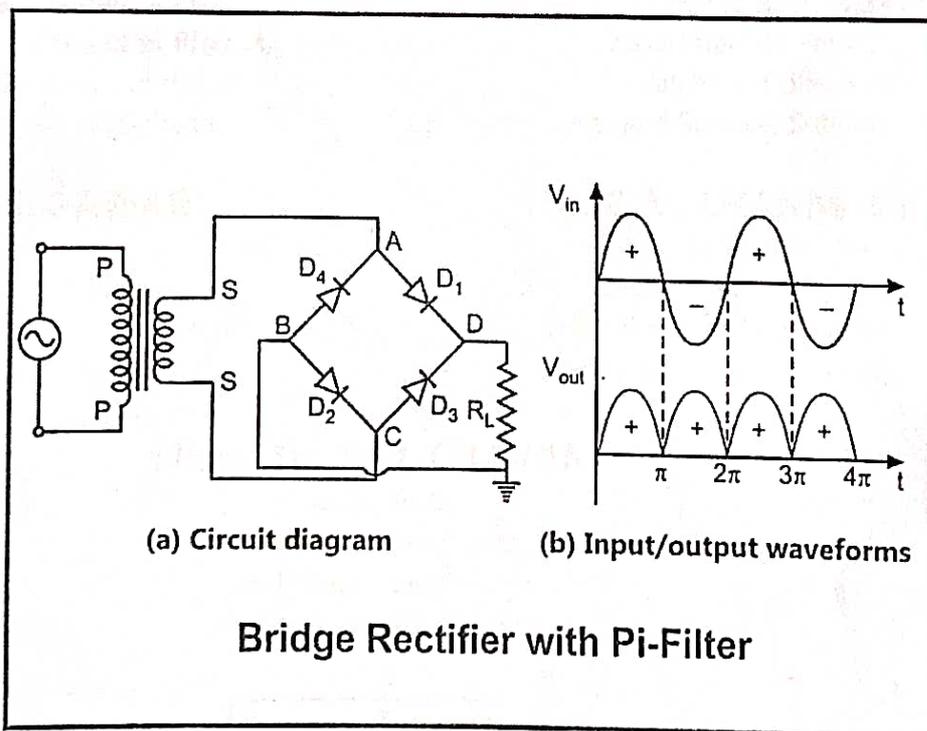
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