O‘zbekiston Respublikasi Oliy ta’lim, fan va innovatsiyalar vazirligi

Toshkent kimyo-texnologiya instituti

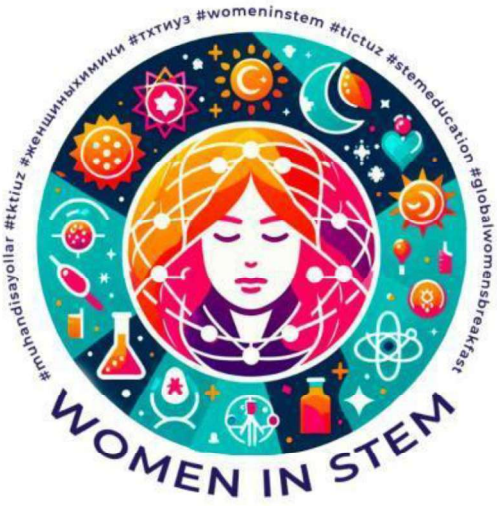
“O‘zkimyosanoat” Aksiyadorlik Jamiyati

O‘zbekiston Respublikasi Oila va xotin-qizlar qo‘mitasi

Oila va gender ilmiy-tadqiqot instituti

Integral Universiteti (Hindiston)

“Neofit Rilski” Janubiy-G’arbiy Universiteti (Bolgariya)



“WOMEN IN STEM”

XALQARO FORUM
ILMIY ISHLAR TO‘PLAMI

BOOK OF PROCEEDINGS

TOSHKENT, 2026-yil, 14-17-FEVRAL

“Women in STEM-2026” ilmiy haftaligi “Innovator ayollar: Ko‘plab ovoz — bitta kelajak” xalqaro ilmiy forumi materiallari. Maqolalar to‘plami. –Toshkent, TKTI, 2026, 572 b. https://doi.org/10.5281/zenodo.18826650

Ushbu to‘plam “11-fevral – BMTning fandagi ayol va qizlar xalqaro kuni” nishonlash doirasida Toshkent kimyo-texnologiya instituti tomonidan 2026 yil 14-17 fevral kunlari tashkil etilgan “Women in STEM-2026” ilmiy haftaligi va “Innovator ayollar: Ko‘plab ovoz — bitta kelajak” mavzusidagi xalqaro ilmiy forumi materiallaridan tashkil topgan.

To‘plam materiallaridan mutaxassis, o‘qituvchi, tadqiqotchi hamda magistratura va bakalavriat talabari foydalanishi mumkin.

Maqolalar mualliflari taqdim etilgan ma'lumotlar, tadqiqot natijalari haqqoniyligi va iqtiboslar to‘g’riligi uchun mas’ul hisoblanadi.

Book of proceedings of the “Women in STEM-2026” science week and international scientific forum “Women-Innovators: Many voices — one future”. Book of proceedings. – Tashkent, TICT, 2026, 572 p. Published online: https://doi.org/10.5281/zenodo.18826650

This collection consists of materials of the international scientific forum “Women-Innovators: Many voices — one future”, organized by the Tashkent Institute of Chemical Technology on February 14-17, 2026, within the framework of scientific week “Women in STEM-2026” and celebration of United Nations “February 11 - International Day of Women and Girls in Science”.

The Book of proceedings can be used by specialists, teachers, researchers, as well as master's and bachelor's degree students.

The authors of the articles are responsible for the accuracy of the information provided, the reliability of the research results, and the correctness of the citations.

“Women in STEM-2026” ilmiy haftaligi, “Innovator ayollar: Ko‘plab ovoz — bitta kelajak” ilmiy forumi, Toshkent kimyo-texnologiya instituti yosh olimlari va talabalari ishtirokida “Kelajak STEM yulduzlari” davra suhbati BMT tomonidan 2015-yilda e’lon qilingan “11-fevral – Fanda ayollar va qizlarning xalqaro kuni”ni nishonlash doirasida tashkil etilgan. Tadbirlar IUPAC xalqaro tadbirlar ro‘yxatiga kiritilgan: *https://iupac.org/gwb/2026/women-innovators-many-voices-one-future/*

The “Women in STEM-2026” scientific week, the “Women Innovators: Many Voices — One Future” scientific forum, and the “Rising STEM Stars” roundtable with the participation of young scientists and students of the Tashkent Institute of Chemical Technology are organized as part of the celebration of “**February 11 - International Day of Women and Girls in Science**” proclaimed by the UN in 2015. The events are included in the IUPAC list of international events: *https://iupac.org/gwb/2026/women-innovators-many-voices-one-future/*

Научная неделя «Women in STEM-2026», научный международный форум «Много голосов — одно будущее» и круглый стол «Будущие звезды STEM» организованы в рамках празднования «**11 февраля – Международного дня женщин и девочек в науке**», объявленного ООН в 2015 году. Мероприятия включены в список международных мероприятий IUPAC: *https://iupac.org/gwb/2026/women-innovators-many-voices-one-future/*

ORGANIZERS OF “WOMEN IN STEM-2026” SCIENTIFIC WEEK:

- Ministry of Higher Education, Science and Innovations of the Republic of Uzbekistan;
- Tashkent Institute of Chemical Technology;
- Joint - Stock Company "Uzkimyosanoat" ;
- Family and Women's Committee;
- Chirchik chemical -industrial technopark ;
- "Ziyo Forum" Foundation for the Development of Science and Education;
- Joint - Stock Company "Maxam-Chirchik ";
- Research Institute "Family and Gender".

INTERNATIONAL ORGANIZATIONS:

- Integral University (India)
- South-West University Neofit Rilski (Bulgaria)
- International Union of Pure and Applied Chemistry (IUPAC)

SESSIONS:

Session 1. "Green Horizons: Innovation and Sustainable Development in Science" (chemistry and chemical technology, food technology and safety, biotechnology, oil and gas processing, energy, astronomy, geology, mathematics, physics, computer science, robotics and IT, engineering).

Session 2. "Nexus Impact: Shaping a Responsible Worldview" (history, sociology, political science, philosophy, economics, pedagogy) **.**

Session 3. "Women Engineers: Designing a Bright Future" (women's contribution to the development of engineering and technology, education, pedagogy, psychology, and philosophy).

Address and contacts of the organizing committee: 100011, Tashkent city, A.Navoiy street, 32. Tashkent Institute of Chemical Technology.

Scientific Secretary of the Conference: Vasila Umarova, tel. +998 97 431-89-77 (Telegram), **tkti.conference@gmail.com**

Conference materials will be posted on the official website of TKTI: https://tkti.uz/research/conference

Book of proceedings of the "Women in STEM-2026" science week and International scientific forum "Women-Innovators: Many voices — one future". https://doi.org/10.5281/zenodo.18826650

ZnO-BASED NANOCOMPOSITES AS EFFICIENT PHOTOCATALYSTS FOR DYE-CONTAMINATED WATER TREATMENT

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Abstract

Industrial wastewater containing synthetic dyes poses a major environmental and health concern because these pollutants are toxic, stable, and difficult to remove using conventional treatment methods. Among various photocatalysts, zinc oxide (ZnO) is extensively studied due to its low cost, chemical stability, non-toxic nature, and strong oxidative potential. Nevertheless, its practical application is restricted by a wide band gap and fast recombination of photo-generated charge carriers, which reduce activity under visible light. Recent progress shows that forming ZnO-based nanocomposites effectively overcomes these limitations by improving light absorption, suppressing charge recombination, and increasing reactive surface sites.

Keywords: ZnO nanocomposites; photocatalysis; dye degradation; water remediation

Introduction

The release of dye containing wastewater from textile, paper, leather, and pharmaceutical industries is a serious environmental issue worldwide. Widely used dyes such as methylene blue, methyl orange, rhodamine B, and malachite green are chemically persistent and can pose toxic and carcinogenic risks [1]. Conventional treatment techniques often fail to completely break down these dyes, resulting in incomplete removal and secondary contamination. Photocatalysis, provides a sustainable approach by degrading organic dyes into harmless end products using light-responsive catalysts [2]. Zinc oxide (ZnO), an n-type semiconductor with a band gap of about 3.2 eV, is widely explored because of its strong redox ability and simple preparation. However, its application is limited by low visible-light response and rapid recombination of photo-generated charge carriers. Consequently, the design of ZnO-based nanocomposites has emerged as an effective strategy to enhance photocatalytic efficiency [3].

Synthesis and Design of ZnO-Based Nanocomposites

ZnO nanocomposites are commonly synthesized using sol–gel, hydrothermal, co-precipitation, sonochemical, and green synthesis routes. The incorporation of secondary materials modifies the electronic structure and surface properties of ZnO, resulting in enhanced photocatalytic activity. Semiconductor heterojunctions such as ZnO/CdS enhance charge separation through interfacial band alignment, leading to superior photocatalytic performance [4] Polymer-supported and porous ZnO nanocomposites further enhance stability and recyclability, which are critical for real wastewater treatment applications [5]. Recent studies clearly demonstrate the high efficiency of ZnO-based nanocomposites for photocatalytic dye degradation under different light sources. ZnO/carbon quantum dot (CQD) nanoflowers achieved 97.7% degradation of methylene blue (MB) within 60 min under natural sunlight, highlighting the role of CQDs in improving light harvesting and charge separation [6]. In another study, a Ni-doped ZnO nanocomposite (Ni/ZnO) showed an outstanding 99.4% degradation of malachite green (MG) in just 40 min under visible light at pH 8, attributed to enhanced visible-light absorption and reduced electron–hole recombination [7].In a recent study, synthesis of nanoconjugates of plant-based ZnO nanoparticles (NPs) conjugated with different thiosemicarbazone ligands viz. salicylaldehyde (STSC), vanillin thiosemicarbazone (VTSC), and 3-acetylpyridine thiosemicarbazone (3-APTSC), through the ultrasonication-assisted

method. ZnO/STSC, ZnO/VTSC, and ZnO/3-APTSC exhibited 61.6%, 90.6%, and 94% degradation of the dye, respectively, in 90 minutes [8].

Conclusions

ZnO-based nanocomposites have emerged as highly effective photocatalysts for dye degradation in water remediation. Composite engineering significantly improves light absorption, charge separation, and photocatalytic efficiency compared to bare ZnO. Continued advancements in material design and process optimization are expected to facilitate their application in sustainable wastewater treatment systems.

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