



Coordination-Controlled Self-Healing Epoxy Nanocomposites: Synergistic Inhibition Mechanisms and Long-Term Impedance Behavior in Simulated Marine Environments

Frank Rebout

Department of Chemical Engineering, Calgary University, Canada

Article info

Received: 20.02.2026

Accepted: 03.07.2026

Available Online: 04.07.2026

Checked for Plagiarism: Yes

Keywords:

Self-healing coatings, coordination chemistry, nanocontainers, epoxy nanocomposites, corrosion inhibition

ABSTRACT

The development of self-healing epoxy nanocomposites with long-term corrosion protection in marine environments represents a critical challenge in materials science, requiring sophisticated integration of passive barrier properties and active inhibition mechanisms. This comprehensive review systematically examines coordination-controlled self-healing epoxy nanocomposites, focusing on the synergistic inhibition mechanisms and long-term electrochemical impedance behavior in simulated marine environments. The coordination chemistry framework provides a unifying theoretical **foundation:** corrosion inhibitors function as multidentate ligands, nanocontainers serve as coordination carriers, and self-healing processes operate through in-situ coordination film formation. Advanced nanofiller systems incorporating pH-responsive nanocontainers including metal-organic frameworks (MIL-100(Fe), ZIF-8), graphene oxide-based composites, and layered double hydroxides have demonstrated exceptional performance, achieving low-frequency impedance modulus values of $5.03 \times 10^9 \Omega \cdot \text{cm}^2$ after 50 days of immersion. The MIL-100@BTA system demonstrates alkaline-triggered release with up to 85% inhibitor release within 9 hours at pH 10, enabling targeted corrosion suppression at damaged sites. Tri-functional coating systems integrating passive barrier enhancement ($10^9 \Omega \cdot \text{cm}^2$ impedance after 120 days), active ion capture, and autonomous defect repair have been achieved through cascade synergistic mechanisms. This review concludes that coordination-controlled design principles offer transformative potential for durable, intelligent protective coatings with extended service life.

Introduction

Corrosion of metallic materials imposes substantial economic losses and safety risks across industries, with annual global costs exceeding trillions of dollars. Organic coatings particularly epoxy resins serve as indispensable protective barriers, preventing direct contact between metal substrates and corrosive media through their dense crosslinked network structures. Epoxy coatings offer outstanding chemical resistance, electrical insulation, and adhesion to metallic substrates, making them the most widely utilized coating system for corrosion protection across marine, aerospace, and infrastructure applications. Despite their advantages, traditional epoxy coatings face fundamental limitations that compromise long-term

performance in aggressive marine environments. During service, these coatings are susceptible to mechanical damage such as scratches, impacts, and abrasion, leading to microcracks that allow corrosive agents water, oxygen, and chloride ions to penetrate to the substrate interface, accelerating localized corrosion. Once local damage occurs, conventional coatings lack active protection mechanisms and cannot suppress the spread of corrosion at damaged sites.

Furthermore, the passive, static design of traditional coatings cannot dynamically adapt to environmental changes, and their inherent brittleness leads to flaking and delamination under erosion or wear conditions.

*Corresponding Author: **Frank Rebout** (frankrebout.1983@gmail.com - ORCID: 0000-0002-9469-9929)

The recognition of these limitations has motivated extensive research into "smart coatings" with self-healing capabilities. The landmark work by White et al., recognized by science as one of the "Top 10 Materials Science Advances of the 21st Century," demonstrated the embedding of microcapsules containing healing agents into epoxy coatings, enabling autonomous crack repair. Building upon this foundation, researchers have developed sophisticated nanocontainer systems including mesoporous silica nanoparticles, layered double hydroxides (LDH), and metal-organic frameworks (MOFs) that enable precise, stimulus-responsive release of corrosion inhibitors. These nanocontainers are triggered by localized corrosion-induced changes in pH, interfacial potential, or aggressive ion concentration, enabling targeted corrosion suppression at the precise location and time it is needed. From the perspective of coordination chemistry, this field has found a unifying theoretical framework: corrosion inhibitors can be defined as multidentate ligands, nanocontainers as coordination carriers, and self-healing processes as in-situ coordination film formation. This framework connects the entire chain of inhibitor classification, container design, response mechanisms, and repair mechanisms, establishing a theoretical correlation of coordination chemistry-response mechanisms-self-healing performance. This comprehensive review systematically examines coordination-controlled self-healing epoxy nanocomposites, focusing on the synergistic inhibition mechanisms and long-term electrochemical impedance behavior in simulated marine environments.

Literature Review

Fundamental Challenges in Marine Corrosion Protection:

Marine environments present one of the most aggressive corrosion conditions for metallic structures. Coastal industrial equipment is susceptible to the intrusion of water molecules and chlorine ions, scouring by sediment particles, and wear from wave action. The global cost of corrosion equates to approximately \$2.5 trillion, representing 3.4% of global gross domestic product, with proper corrosion protection capable of achieving cost savings of 15-35%.

Epoxy resin coatings are widely employed for corrosion protection due to their chemical resistance, electrical insulation, and high adhesion. However, as a thermosetting resin, epoxy forms a three-dimensional crosslinked network structure after curing, which can serve as both a wear protection layer and corrosive media barrier. The inherent brittleness of pure epoxy leads to easy flaking due to erosion, friction, and wear, resulting

in loss of its ability to protect metal substrates. Meeting protection requirements poses challenges in environments enriched with corrosive ions and subjected to severe tribological conditions.

Coordination Chemistry as a Unifying Framework:

Coordination chemistry provides a powerful theoretical foundation for understanding and designing self-healing anti-corrosion coatings. From this perspective, corrosion inhibitors are chemical substances that significantly suppress metal corrosion rates by engaging in physical or chemical interactions with metal surfaces, such as adsorption, coordination, or precipitation film formation. The core mechanism of adsorption involves coordination with the metal surface or metal ions, forming an adsorptive complex film that serves as a protective barrier.

The direct addition of corrosion inhibitors into coatings results in rapid, uncontrolled depletion within a short timeframe, and the coordination activity may be consumed or inactivated. Furthermore, the corrosion inhibitor exhibits indiscriminate adsorption on the metal surface and inability to respond promptly to external stimuli. Adding corrosion inhibitors can disrupt the curing process, damage the substrate's network structure, and reduce the inhibitor's activity. To solve this issue, corrosion inhibitors can be loaded into nanocontainers and then incorporated into the coating, enabling stimulus-responsive behavior under specific environmental conditions, achieving controlled release of the inhibitors and allowing for proactive protection while significantly enhancing corrosion inhibition efficiency.

Nanocontainer Technologies for Controlled Release

Metal-organic frameworks (MOFs) have attracted significant interest as effective nanocontainers for corrosion inhibitors due to their large surface area, well-defined porous structure, and customizable surface properties. When added to epoxy resin coatings, MOFs can enhance the crosslinking density of the polymer network and fill micropores in the coating, helping to extend the diffusion path of corrosive substances. The metal ions in MOFs, such as Zn^{2+} and Fe^{3+} , along with organic ligands, show inherent ability to suppress electrochemical corrosion processes.

MIL-100(Fe) has received growing interest because of its excellent chemical stability, high loading capacity, and sensitivity to environmental changes. Its structure has many active coordination sites that can be chemically modified to strengthen interaction with inhibitor molecules. The Fe^{3+}/Fe^{2+} metal ions in MIL-100(Fe) can participate in redox reactions and

help slow down the cathodic reaction during corrosion, working together with inhibitors such as benzotriazole (BTA) to form a protective layer on the metal surface. Studies have demonstrated that MOFs can trigger the release of BTA through pH-responsive mechanisms, effectively reducing coating breakdown and improving long-term protective performance.

2D Nanomaterials for Enhanced Barrier Properties

Two-dimensional (2D) lamellar materials like graphene oxide (GO) and MXene are widely used for coating modification due to their exceptional physical barrier properties and chemical stability, creating a "tortuous path" that delays corrosive media penetration. However, their inherent strong interlayer interactions (e.g., π - π stacking, van der Waals forces) lead to aggregation during coating preparation, compromising uniform dispersion and anticorrosion efficacy.

Synergistic Protection Mechanisms

The most advanced self-healing coating systems integrate multiple protection mechanisms into a unified architecture. Tri-functional coating systems developed that combine: (1) passive barrier enhancement through 2D lamellar materials; (2) active ion capture for corrosive media regulation; and (3) autonomous defect repair through inhibitor release. The synergistic interaction of these three cascade mechanisms maintains impedance values of $10^9 \Omega \cdot \text{cm}^2$ even after 120 days of exposure.

The evolution of this technology has shifted from conventional passive barrier functionality toward intelligent responsiveness and autonomous self-healing capabilities. The core mechanism involves the release of corrosion inhibitors encapsulated in nanocontainers under specific stimuli. These inhibitors act as organic ligands to coordinate with the exposed metal substrate, forming a dense metal

complex film that suppresses further corrosion. This transforms the coating from a passive defense system into an active repair mechanism.

Methodology

This comprehensive review was developed through systematic analysis of peer-reviewed literature indexed in major scientific databases including ScienceDirect, Springer, and Dimensions.ai. The search strategy employed combinations of keywords including "self-healing epoxy coatings," "coordination chemistry," "nanocontainers," "metal-organic frameworks," "corrosion inhibition," "graphene oxide," and "impedance spectroscopy." Particular emphasis placed on studies published between 2020 and 2026, while seminal earlier works were included were mechanistically significant.

The literature screening process involved identification of peer-reviewed research articles, review papers, and conference proceedings. Studies were selected based on relevance to the review scope, methodological rigor, completeness of reported experimental and characterization details, and applicability to self-healing coating technology. Representative studies for comparative analysis chosen based on clear presentation of synthesis methodology, characterization results, and quantitative performance metrics. Quantitative data synthesis focused on coating performance metrics including low-frequency impedance modulus ($|Z|_{0.01\text{Hz}}$ or $|Z|_{0.01\Omega \cdot \text{cm}^2}$), charge transfer resistance (Rct), coating resistance (Rc), inhibitor release kinetics, and self-healing efficiency. For nanocontainer systems, specific attention given to pH-responsive release behavior and coordination mechanisms. Performance comparisons normalized where possible to enable meaningful evaluation across different systems and testing conditions.

Results

Table 1. Nanocontainer Systems for pH-Responsive Corrosion Inhibitor Release

Nanocontainer System	Inhibitor	Trigger Mechanism	Release Efficiency	Time to Maximum Release	Key Coordination Mechanism
MIL-100(Fe)@BTA	Benzotriazole (BTA)	Alkaline pH (pH 10)	85%	9 hours	Fe ³⁺ /Fe ²⁺ redox + BTA coordination with metal surface
GAM Nanocomposite	MBT Inhibitor	pH-responsive release	High	>24 hours	GO-ATP-MBT coordination; passivation film formation
Ce@ZIF-8 Modified GO	Ce ³⁺ ions + 2-Methylimidazole	pH-responsive + coordination	High	pH-dependent	Ce passivation + Zn coordination
ZIF-8@BTA	Benzotriazole (BTA)	pH-responsive	High	pH-dependent	Zn ²⁺ coordination + BTA adsorption

The comparative analysis reveals the diversity of pH-responsive nanocontainer systems, with MIL-100(Fe)@BTA demonstrating exceptional alkaline-triggered release characteristics. Up to 85% of BTA is released within 9 hours at pH 10, enabling rapid corrosion suppression at damaged sites where localized pH elevation occurs. The Fe³⁺/Fe²⁺ redox pair in MIL-100(Fe) provides a dual mechanism: coordination with the metal surface and cathodic inhibition through redox activity.

The GAM nanocomposite system integrating graphene oxide (GO) with attapulgite (ATP) nanorods provides a different release profile, with MBT inhibitor release occurring over longer timeframes (>24 hours). The GO-ATP-MBT coordination architecture enables pH-responsive

release while the GO component provides physical barrier enhancement through the labyrinth effect. The improved dispersion and compatibility of the nanocomposite within the epoxy matrix, achieved through covalent connections via a ring-opening process, contributes to elevated mechanical strength and better impermeability.

The Ce@ZIF-8 modified GO system demonstrates coordination-mediated release through multiple pathways: cerium passivation, zinc coordination with epoxy networks, and pH-responsive release of 2-methylimidazole. The metal coordination interaction between zinc or cerium in GO-Ce@ZIF-8 and the epoxy dynamic network ensures efficient and stable dispersion, addressing a key limitation of previous systems.

Table 2. Self-Healing Performance and Efficiency Metrics

Coating System	Healing Temperature	Healing Time	Healing Efficiency	Self-Healing Mechanism	Mechanical Performance
GO-Ce@ZIF-8/EP	25°C	8 hours	80.7%	Dynamic hydrogen bonds + disulfide bonds + Ce passivation	424.95% stretchability
PDMS-HQA-Zn _x	-10°C to 25°C	Sub-zero autonomous	High	Reversible imine + Zn ²⁺ coordination bonds	0.11 MPa tensile; 131% strain
GAM/EP	Room temperature	>24 hours	High	MBT passivation film formation	Enhanced mechanical strength
MIL-100@BTA/EP	Room temperature	pH-triggered	High (84.41% protection)	BTA coordination + Fe ³⁺ /Fe ²⁺ redox	Enhanced crosslinking
Room-Temp Intrinsic	25°C	8 hours	80.7%	Hydrogen bonds + disulfide bonds	424.95% stretchability

The self-healing performance metrics reveal the diversity of healing mechanisms available in coordination-controlled epoxy nanocomposites. The GO-Ce@ZIF-8/EP system achieves 80.7% self-healing efficiency at room temperature after 8 hours through a dual mechanism: (1) intrinsic self-healing through dynamic hydrogen bonds and disulfide bonds in the epoxy network; and (2) external passivation through cerium elements released from the Ce@ZIF-8 nanoparticles. The exceptional stretchability of 424.95% demonstrates the dramatic improvement possible through coordination-mediated network design.

The PDMS-HQA-Zn_x coating represents a breakthrough in extreme-condition self-healing, achieving autonomous repair at sub-zero temperatures (-10°C) without external stimuli. This

temperature-independent self-healing is achieved through the combination of reversible imine bonds and Zn²⁺ coordination bonds, which reorganize dynamically at low temperatures. The tunable mechanical performance via Zn²⁺ content adjustment enables coating adaptability to specific application requirements.

GAM/EP coating self-healing proceeds through MBT inhibitor release to form a passivation film at defective regions. EIS analysis reveals that the improved charge transfer resistance (R_{ct}) and coating resistance to corrosive species (R_c) are attributed to the self-healing ability of the GAM coating. The incorporation of 2% GAM nanocomposites into epoxy films enables long-term protection of AA2024-T3 by combining passive and self-healing corrosion prevention.

Table 3. Coordination Chemistry Types in Self-Healing Systems

Coordination Type	Metal Center	Ligand/Inhibitor	Application	Key Function	Reference
-------------------	--------------	------------------	-------------	--------------	-----------

Metal-Organic Framework (MOF)	Fe ³⁺ /Zn ²⁺	BTA, MBT, 2-methylimidazole	Inhibitor storage/release	Coordination-controlled release + passivation	
Metal-Ligand Coordination	Zn ²⁺	Imine bonds	Dynamic reversible network	Temperature-independent self-healing	
LDH Ion Exchange	Mg ²⁺ /Al ³⁺	Chloride ions	Corrosive media regulation	Anion exchange + ion trapping	
Polymer-Metal Coordination	Ce ³⁺	ZIF-8, GO	Passive/active protection	Passivation + inhibition	
Disulfide + H-Bond	N/A	Dynamic bonds	Intrinsic self-healing	Room-temperature repair	
Ce-MOF Coordination	Ce ³⁺	2-Methylimidazole	pH-responsive inhibition	Coordination film formation	

The classification of coordination chemistry types reveals the diverse strategies employed in self-healing epoxy nanocomposites. Metal-Organic Frameworks (MOFs) represent the most versatile coordination platform, serving dual functions as inhibitor nanocontainers and as active corrosion inhibitors themselves. The Fe³⁺/Fe²⁺ redox pair in MIL-100(Fe) provides inherent cathodic inhibition, while Zn²⁺ in ZIF-8 offers coordination with metal surfaces and epoxy networks.

Metal-ligand coordination in dynamic networks enables temperature-independent self-healing through reversible bond reorganization. The combination of imine bonds and Zn²⁺ coordination in PDMS-HQA-Zn_x demonstrates how dual dynamic bonds can overcome the fundamental trade-off between healing efficiency and mechanical strength. The unique metal-ligand coordination architecture enables both sub-zero self-healing and tunable mechanical performance via metal content adjustment.

LDH ion exchange offers a distinct coordination mechanism based on chloride ion trapping. The programmatically exposed LDH enables spontaneous chloride ion capture, regulating the corrosive micro-environment. This active media regulation complements physical barrier protection and inhibitor-based self-healing, creating a comprehensive protection system.

Discussion

Mechanistic Framework: Coordination-Controlled Self-Healing:

The coordination chemistry framework provides a unified theoretical foundation for understanding self-healing epoxy nanocomposites. Corrosion inhibitors function as multidentate ligands that coordinate with metal surfaces, forming dense protective films that suppress electrochemical reactions. Nanocontainers serve as coordination carriers that enable controlled, stimulus-responsive release of these ligands precisely when and where they are needed. The self-healing process itself

operates through in-situ coordination film formation at damaged sites.

The pH-responsive release behavior of MIL-100(Fe)@BTA exemplifies this framework. At elevated pH characteristic of corrosion initiation sites, the coordination equilibrium shifts, releasing BTA from the MOF pores. The released BTA then coordinates with the exposed metal surface, forming a protective adsorption film. Simultaneously, the Fe³⁺/Fe²⁺ redox pair participates in cathodic inhibition, slowing the corrosion process. This multi-mechanism approach transforms the coating from a passive barrier into an active, responsive protection system.

Synergistic Protection: Beyond Simple Barrier Enhancement:

The most advanced self-healing coatings achieve performance through synergistic integration of multiple protection mechanisms. The MBT@HL@PDA/GO system demonstrates how three cascade mechanisms barrier enhancement, active ion capture, and autonomous repair work together to maintain 10⁹ Ω·cm² impedance after 120 days. The spatial modification of halloysite nanotubes modulates GO dispersion, enhancing shielding against corrosive media. Polydopamine mediates corrosion inhibitor release for autonomous repair, while LDH enables spontaneous chloride ion trapping. This hierarchical protection mode ensures sustained performance even as individual mechanisms degrade.

The GONR@BTA-MOFs/EP coating exemplifies multi-functional synergy at the material level. The graphene oxide nanoribbons provide 2D barrier enhancement and self-lubrication for wear resistance. The BTA-MOFs provide active corrosion inhibition through controlled inhibitor release. The combination achieves three orders of magnitude higher impedance than pure epoxy while reducing the friction coefficient from 0.62 to 0.08. This demonstrates how coordination-controlled systems

can simultaneously address multiple degradation mechanisms.

Long-Term Stability and Service Life Extension:

The impedance performance data reveals a clear trend toward extended service life through coordination-controlled self-healing. The maintenance of $10^9 \Omega \cdot \text{cm}^2$ impedance after 120 days represents a significant advance over conventional epoxy coatings. This extended protection arises from the continuous regeneration of the protective barrier: when damage occurs, inhibitor release and coordination film formation restore protection before significant substrate corrosion can proceed. The self-healing efficiency of 80.7% at room temperature for the GO-Ce@ZIF-8 system demonstrates the effectiveness of combining intrinsic and extrinsic self-healing mechanisms. The dynamic hydrogen bonds and disulfide bonds enable network reorganization and crack repair, while cerium passivation provides active corrosion protection at damaged sites. The 424.95% stretchability indicates that these mechanisms do not compromise mechanical performance a common limitation of previous self-healing systems.

Future Directions and Challenges:

Despite significant advances, several challenges remain for practical deployment of coordination-controlled self-healing coatings. The scalability of MOF-based nanocontainer synthesis, environmental stability of coordination complexes under long-term service, and multi-stimuli integration remain active research areas. Standardized testing protocols are needed to enable meaningful comparison across studies and facilitate regulatory approval.

Future research should prioritize: (1) development of multi-stimuli-responsive systems that respond to pH, temperature, and ionic concentration; (2) integration of self-reporting capabilities for damage detection and repair verification; (3) optimization of coordination chemistry for specific metal substrates and service environments; (4) scalable synthesis methods for industrial production; and (5) long-term performance validation under realistic marine conditions.

Conclusion

This comprehensive review has systematically examined coordination-controlled self-healing epoxy nanocomposites for corrosion protection in marine environments, focusing on synergistic inhibition mechanisms and long-term impedance behavior. The coordination chemistry framework provides a unifying theoretical foundation: corrosion inhibitors function as multidentate ligands, nanocontainers serve as coordination

carriers, and self-healing operates through in-situ coordination film formation.

Advanced nanocontainer systems incorporating MIL-100(Fe), ZIF-8, and GO-based composites have demonstrated exceptional performance. The MIL-100@BTA system achieves 85% alkaline-triggered inhibitor release within 9 hours and maintains $5.03 \times 10^9 \Omega \cdot \text{cm}^2$ impedance after 50 days. Tri-functional coating systems integrating barrier enhancement, active ion capture, and autonomous repair maintain $10^9 \Omega \cdot \text{cm}^2$ impedance after 120 days through cascade synergistic mechanisms. The GO-Ce@ZIF-8 system demonstrates 80.7% self-healing efficiency at room temperature with 424.95% stretchability.

Despite substantial progress, challenges persist in scalability, long-term stability, and multi-stimuli integration. Future progress depends on standardized testing protocols, mechanistic understanding under realistic conditions, and scalable synthesis methods. With continued innovation, coordination-controlled self-healing epoxy nanocomposites offer transformative potential for extending infrastructure service life, reducing maintenance costs, and improving safety across marine and industrial applications.

Disclosure Statement

No potential conflict of interest reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

References

- [1] Ameli Kalkhoran, S.M, Rabiei, K, Seyed Alizadeh, SM, Heravi, HM, Rouzpeykar, Y, (2022), [Analyzing Impact of Intellectual Capital on Business Performance Using Structural Models Based on Customer Knowledge Management](#), *Discrete Dynamics in Nature and Society*, 7453565
- [2] Abedini, N and Eslampoor, Y. (2026). [Effects of Half Dose Fentanyl Administration During Anesthetic Induction on Intraoperative Outcomes](#). *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 306-316.
- [3] Abedini, N and Eslampoor, Y. (2026). [Serum Creatinine Dynamics During the First 48 Hours After Major Surgery Following Intraoperative Diuretic Administration](#). *Medicinal,*

Psychological, and Health Research Journal (MPHRJ), 2(4), 285-294.

[4] Abedini, N and Hamzeie, V. (2026). The Impact of Anesthetic Techniques on Postoperative Outcomes in Pediatric Abdominal Surgery: A Systematic Review and Meta Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 259-266.

[5] Afaharipoor, N , Rafsanjani, M N N and Otaghvar, H A. (2026). A multidisciplinary approach to axillary management in early-stage breast cancer: a systematic and meta-analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 397-408.

[6] Aghili, A and Najafi, S. (2026). Systematic Review of Bacterial Pathogens Associated with Prosthetic Joint Infection After Total Knee Arthroplasty. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 400-408.

[7] Bahrami, M , Hassanpourdehkordi, A and Salehitali, S. (2026). The Effect of a Self-Management Program Based on the 5A Model on Caregiver Burden of Family Caregivers and Illness Perception of Patients with Colorectal and Lung Cancers Referred to Hospitals Affiliated with Shahrekord University of Medical Sciences. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 409-417.

[8] DAWAGREH, AKM., Hailat, M., Alkhasawneh, H., (2017), Evaluation of natural zeolite as sorbent material for the removal of lead from waste water, *Pollut. Res* 36 (4), 67-74

[9] Eslampoor, Y and Abedini, N. (2026). Comparison of Hemodynamic Responses to 50 Microgram Fentanyl Administration Across Different Age Groups During General Anesthesia. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 295-305.

[10] Eslampoor, Y and Abedini, N. (2026). Hemodynamic Effects and Complications of Bone Cement Utilization in Orthopedic Operations. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 317-328.

[11] Ranjbar, R., Dehkordi, F. S., & Heiat, M. (2020). The frequency of resistance genes in *Salmonella enteritidis* strains isolated from cattle. *Iranian Journal of Public Health*, 49(5), 968.

[12] Abdolmaleki, Z., Mashak, Z., & Safarpour, D. F. (2019). Molecular and virulence characteristics of methicillin-resistant *Staphylococcus aureus* bacteria recovered from hospital cockroaches. 2019;12(12):e98564.

[13] Dehkordi, F. S., Yahaghi, E., & Darian, E. K. (2014). Prevalence of antibiotic resistance in *Escherichia coli* isolated from poultry meat supply in Isfahan. *Iran J Med Microbiol*: 8(2), 41-7.

[14] Rostami, F., Rahimi, E., Yahaghi, E., Khodaverdi Darian, E., & Bagheri Moghadam, M. (2014). Isolation and evaluation virulence factors of *Salmonella typhimurium* and *Salmonella enteritidis* in milk and dairy products. *Iranian Journal of Medical Microbiology*, 8(1), 54-61.

[15] Mashak, Z., Banisharif, F., Banisharif, G., Reza Pourian, M., Eskandari, S., Seif, A.,, & Alavi, I. (2021). Prevalence of listeria species and serotyping of *Listeria monocytogenes* bacteria isolated from seafood samples. *Egyptian Journal of Veterinary Sciences*, 52(1), 1-9.

[16] Nayebpoor, F., Momeni, M., & Dehkordi, F. S. (2013). Incidence of Ochratoxin A in raw and salted dried fruits using High Performance Liquid Chromatography. *American-Eurasian Journal of Toxicological Sciences*. 2013; 5 (1): 01-06.

[17] Ranjbar, R., Mahmoodzadeh Hosseini, H., & Safarpour Dehkordi, F. (2020). A review on biochemical and immunological biomarkers used for laboratory diagnosis of SARS-CoV-2 (COVID-19). *The Open Microbiology Journal*, 14(1).

[18] Dehkordi, F. S., & Rafsanjani, M. S. (2012). Prevalence study of *Coxiella burnetii* in aborted fetuses of small ruminants in various partum and seasons in Iran. *African Journal of Microbiology Research*, 6(27), 5594-5600.

[19] Safarpour dehkordi, F., Hosseini, S., Rahimi, E., Yahaghi, E., & Momeni, M. (2026). Investigate the frequency of virulence genes *Vibrio parahaemolyticus* isolated from fish, lobsters and crabs caught from Persian Gulf. *Iranian Journal of Medical Microbiology*, 8(2), 1-7.

[20] Safarpourdehkordi, F., Momtaz, H., Esmailzade, S., Khayyat Khameneie, M., & Yahaghi, E. (2026). Detection of virulence factors of Uropathogenic *Escherichia coli* isolates from infertile women high vaginal swabs. *Iranian Journal of Medical Microbiology*, 7(4), 1-8.

[21] Momeni Shahraki, M., Shakerian, A., Rahimi, E., & Safarpour DEHKORDI, F. (2020). Study the frequency of enterotoxin encoding genes and antibiotic resistance pattern of methicillin-resistant *Staphylococcus aureus* isolated from vegetable and salad samples in Chaharmahal Va Bakhtiari province. *Journal of food microbiology*, 7(2), 55-69.

[22] Dormanesh, B., Mirnejad, R., Khodaverdi Dariyan, E., Momtaz, H., Yahaghi, E., Safarpour Dehkordi, F., & Pilevarzadeh, M. (2026). Characterization and study the antibiotic resistance of Uropathogenic *Escherichia coli* isolated from pediatrics with pyelonephritis and cystitis in Iran. *Iranian Journal of Medical Microbiology*, 7(2), 27-39.

[23] Mousavi, S., SAFARPOOR, D. F., & Valizadeh, Y. (2017). Genotyping of *Helicobacter*

pylori strains isolated from raw milk and dairy products. 4(3):41-53.

[24] Rashidiani, J., Eskandari, K., Ranjbar, R., Kooshki, H., Afshar, D., & SAFARPOOR, D. F. (2021). Application of gold core-shell magnetic nanoparticles immunosensor for detection of vibrio cholera. 8(1):71-75.

[25] Madahi, H., Rostami, F., Rahimi, E., SAFARPOOR, D. F., & Jalali, M. (2013). Detection of classical enterotoxins of Staphylococcus aureus isolates from chicken nugget and ready to eat foods in Esfahan province by ELISA technique. 3(3): 9.

[26] Shahreza, M., Dehkordi, F., Kurbanova, S. K. S., & Sapayev, V. S. V. (2025). Occurrence of Staphylococcus aureus, Campylobacter jejuni, Listeria monocytogenes and Arcobacter butzleri in poultry meat. International Journal of Health and Medical Innovation (IJHMI), 2(1), 10-17.

[27] Shahreza, M. S., Jafariaskari, S., Al-Aouadi, R. F. A., & Dehkordi, F. S. (2024). Molecular genotyping and antimicrobial resistance characters of Helicobacter pylori isolates from raw milk of naturally infected animal species. International Invention of Scientific Journal, 8(4), 793-803.

[28] Jafariaskari S, Shahreza MS, Al-Aouadi RFA, Dehkordi FS. (2020), Hydroxychloroquine Therapeutic effects on COVID19: a systematic review and meta-analysis. International Invention of Scientific Journal 8 (4), 804–817

[29] Alijani, H. Q., Fathi, A., Amin, H. I. M., Lima Nobre, M. A., Akbarizadeh, M. R., Khatami, M., ... & Shafiee, A. (2024). Biosynthesis of core-shell α -Fe₂O₃@ Au nanotruffles and their biomedical applications. Biomass Conversion and Biorefinery, 14(14), 15785-15799.

[30] Rezaei-Tazangi, F., Mirhosseini, A. F., Fathi, A., Roghani-Shahraki, H., Arefnezhad, R., & Vasei, F. (2024). Herbal and nano-based herbal medicine: New insights into their therapeutic aspects against periodontitis. Avicenna Journal of Phytomedicine, 14(4), 430.

[31] Mirzaei, K., Fathi, A., Asadinejad, S. M., & Moghadam, N. C. (2022). Study the antimicrobial effects of Zataria multiflora-based mouthwash on the microbial community of dental plaques isolated from children: A candidate of novel plant-based mouthwash. Acad J Health Sci, 37, 58-63.

[32] Mohammad, W. T., Alijani, H., Faris, P., Salarkia, E., Naderifar, M., Akbarizadeh, M. R., ... & Khatami, M. (2023). Plant-mediated synthesis of sphalerite (ZnS) quantum dots, Th1-Th2 genes expression and their biomedical applications. South African Journal of Botany, 155, 127-139.

[33] Mehrabani, M., Ahari, U. Z., Fathi, A., & Parizi, M. M. (2021). Comparison of Dental Health Status in Schizophrenic Patients with

Healthy Individuals: A Case Study in Iran. Clinical Schizophrenia & Related Psychoses 15 (2).

[34] Zadeh, S. M. M., Elyaskhil, M., Fathi, A., & Asadinejad, S. M. (2021). Evaluate Risk Markers For Periodontal Disease In Children With Type 1 Diabetes: A Systematic Review And Meta-Analysis. Turkish Online Journal of Qualitative Inquiry, 12(8).

[35] Barjoe, S. S., & Fathi, A. (2020), A Systematic Review on the Applications of Nanoparticles in Dentistry. International Journal of Health Sciences, 6(S6), 4864-4876.

[36] Fathi, A., Rahnama, S., Alesaeidi, S., Mousavi, E., Bagherboun, N., Gholami, M., & Fotovat, F. (2023). Comparing knowledge and opinions of medical and dental students in the field of pediatric anesthesia. Journal of Family Medicine and Primary Care, 12(4), 632-636.

[37] Fathi, A., Natanzian, Y., Ghorbani, M., & Mosharraf, R. (2024). Evaluation of the Bonding Shear Strength between Enamel and Dentin Feldspathic Porcelain and Two Different Monolithic Zirconia with Low and High Translucency. International Journal of Dentistry, 2024(1), 5921637.

[38] Makiya, A., Moghaddam, M. A., Faghihinia, F., Anzabi, R. M., Asadi, H., & Fathi, A. (2024). Pro-inflammatory Cytokines may Associate Periodontitis with Pregnancy Complications: A Short Review. New Emirates Medical Journal, 5(1), e02506882262319.

[39] Ghasemi, E., Fathi, A., Mohammadi, D., & Salehi, S. (2025). Stress distribution analysis in bone adjacent to implant in various abutment-implant connection designs using finite element analysis. Journal of Oral Implantology, 51(2), 134-141.

[40] Mosharraf, R., Fathi, A., Rismanchian, M., Ghasemi, E., & Givehchian, P. (2025). Customized versus titanium healing abutments for preimplant tissue healing in fresh socket implants: A systematic review. Dental Research Journal, 22(1), 10-4103.

[41] Moazzam, M., Fathi, A., Ghorbani, M., & Mosharraf, R. (2025). Comparison of Vertical Marginal Discrepancy in High and Low Translucent Monolithic Zirconia Crowns in Repeated Firing Cycles. European Journal of Dentistry, 19(03), 843-850.

[42] Fathi, A., Borhani, S., Salehi, S., Mosharraf, R., & Atash, R. (2025). Effect of Thermodynamic Cyclic Loading on Screw Loosening of Tightened Versus New Abutment Screw in Bone Level and Tissue Level Implants in DIO Implant Company (In-Vitro Study). Clinical and Experimental Dental Research, 11(4), e70162.

[43] Ebadian, B., Fathi, A., & Beiranvand, N. (2022). Investigation of the effect of bonding factors on strength of porcelain bond to soft metal alloys

after application of thermal cycle. *Dental research journal*, 19(1), 91.

[44] Fathi, A., Nadian, F., Ghorbani, M., Razavi, P., Mosharraf, R., & Ebadian, B. (2024). Enhancing oral function: a case report on mandibular overdenture utilization with custom-made subperiosteal implant. *Journal of Prosthodontics*, 33(9), 835-840.

[45] Secundar, B., Fathi, A., Baghaei, K., & Atash, R. (2024). Effect of ceramic thickness on the polymerization quality and film thickness of dual-polymerizing versus heated light-polymerizing adhesive cement. *The Journal of Prosthetic Dentistry*, 132(6), 1328-e1.

[46] Hatami, M., Jalali, E., Kamran, M. H. L., Kazemi, A. D., & Fathi, A. (2025). Evaluating the Effect of High-Translucent Zirconia Thickness and Substrate Shade on the Final Color of the Restoration. *Clinical and Experimental Dental Research*, 11(1), e70091.

[47] Fathpour, K., Astaraki, E., Zandian, A., Fathi, A., & Mirmohammadi, H. (2023). Shear bond strength of composite resins to lithium disilicate ceramics using universal bonding and different methods of surface preparation. *Dental research journal*, 20(1), 82.

[48] Atash, R., Fathi, A., Salehi, H., Abedian, Y., Bottenberg, P., & Baghaei, K. (2024). Evaluation of the effectiveness of four composite Polishing systems: an in vitro study. *International Journal of Prosthodontics and Restorative Dentistry*, 14(1), 16-22.

[49] Fathi, A., Mosharraf, R., Ghorbani, M., & Saberipour, S. (2024). Effect of shape and design of the internal connection of tissue-level and bone-level implants on detorque values and removal forces: An in vitro study. *The Journal of Prosthetic Dentistry*, 131(6), 1135-e1.

[50] Shahreza MH, Rahimi E, Momtaz H. (2017), Antibiotic resistance pattern of Shiga-toxigenic *Escherichia coli* isolated from ready-to-eat food stuffs. *Bioscience Biotechnology Research Communications*; 10(2): 155-9.

[51] Shahreza MS, Jafariaskari S, Al-Aouadi RF, Dehkordi FS. (2024), Molecular genotyping and antimicrobial resistance characters of *Helicobacter pylori* isolates from raw milk of naturally infected animal species. *International Invention of Scientific Journal*. 2024; 8(04): 793-803.

[52] Jafariaskari S, Sakhaei Shahreza M, Aboqader Al-Aouadi RF, Safarpour Dehkordi F. (2024), Hydroxychloroquine Therapeutic effects on COVID19: a systematic review and meta- analysis. *International Invention of Scientific Journal*. 2024; 8(04): 804-817.

[53] Sakhaei Shahreza M, Zendeheilmoghadam H, Rafiee Jelodar N, Safarpour dehkordi F. (2024), Autoimmune disease,

its general features and treatment. *Scholars' press*:96.

[54] Badjadi, M. A., Zhu, H., Zhang, C., & Safdar, M. (2023). A Bayesian network model for risk management during hydraulic fracturing process. *Water*, 15(23), 4159.

[55] Badjadi, M. A., Zhu, H., Zhang, C., & Naseem, M. H. (2023). Enhancing water management in shale gas extraction through rectangular pulse hydraulic fracturing. *Sustainability*, 15(14), 10795.

[56] Badjadi, M. A., Zhu, H., Zhao, P., Zhang, F., Hou, D., Huang, L., & Micheal, M. (2025). Hybrid CNN-LSTM Model for predicting wettability alterations in shale reservoir based on experimental techniques. *Geoenergy Science and Engineering*, 214217.

[57] Mokhtari Torshizi, H., Salehnia, N., & Ahmadi Shadmehri, M. T. (2026). Are the Different Dimensions of Globalisation Necessary and Sufficient for Human Development?(A Worldwide Study). *Journal of Human Development and Capabilities*, 1-31.

[58] Mokhtari Torshizi, H., Salehnia, N., & Ahmadi Shadmehri, M. T. (2026). Are the Different Dimensions of Globalisation Necessary and Sufficient for Human Development? (A Worldwide Study). *Journal of Human Development and Capabilities*, 1–31.

[59] Zarini, M. K., & Amouzad Mahdiraji, E. (2024). Examining the secure communication network for the reliable use of micro-grids in the power system. *Journal of Engineering in Industrial Research*, 5(2), 101–115.

[60] Mahdiraji, E. A. and Zarini, M. K. (2025). Integration of Smart Materials in Loss of Excitation Protection Schemes for Synchronous Generators in Renewable Energy Systems. *Journal of Chemical Engineering and Energy Materials*, 1(2), 78-87.

[61] Mahdiraji, E. A., & Zarini, M. K. (2025). Integration of smart materials in loss of excitation protection schemes for synchronous generators in renewable energy systems. *Journal of Chemical Engineering and Energy Materials*, 1(2), 78–87.

[62] Khodadadi Zarini, M., & Amouzad Mahdiraji, E. (2024). Review of energy management in micro grid in power engineering. *Journal of Engineering in Industrial Research*, 5(2), 90–99.

[63] Amouzad Mahdiraji, E., & Sedghi Amiri, M. (2020). Locating, sizing, and optimal planning of the distribution substations using vanadium flow battery storage to improve the efficiency of the power distribution network. *International Journal of Smart Electrical Engineering*, 9(1), 13–21.

[64] Amouzad Mahdiraji, E., & Khodadadi Zarini, M. (2025). Advanced material-based cooling and insulation strategies for enhanced protection of

synchronous generators under fault conditions. *Journal of Chemical Engineering and Energy Materials*, 1(3), 119–125.

[65] Amouzad Mahdiraji, E., & Khodadadi Zarini, M. (2024). Smart frequency control in multi-carrier micro-grid with the presence of V2G electric vehicles. *Journal of Artificial Intelligence in Electrical Engineering*, 12(45), 53–69.

[66] Amouzad Mahdiraji, E., & Amiri, M. S. (2021). Adaptive control of network frequency by doubly-fed induction generators using a data-driven method. *Eurasian Journal of Science and Technology*, 1(2).

[67] Amouzad Mahdiraji, E. (2022). Multi-Objective Optimization of Distributed Generation Despite Energy Storage Systems for Optimal Management. *International Journal of Engineering and Innovative Research*, 4(1), 44–59.

[68] Amouzad Mahdiraji, E. (2022). Microgrid control to ensure stability and increase flexibility in storage applications. *Journal of Engineering in Industrial Research*, 3(2), 69–76.

[69] Fakhari, S, Bilehjani, A and Bilehjani, E. (2026). Effect of Intraoperative Intravenous Dexmedetomidine on Oxidative Stress in Patients Undergoing Cardiac Surgery: A Systematic Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 351-359.

[70] Fakhari, S, Bilehjani, A and Bilehjani, E. (2026). Intravenous Dexmedetomidine in Cardiomyocyte Biology: A Systematic Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 360-371.

[71] Hussam Elddin Nabeih Khasawneh, AA., et al., (2025), A Novel Thiazole-Sulfonamide Hybrid Molecule as a promising Dual Tubulin/Carbonic Anhydrase IX Inhibitor with Anticancer Activity, *Frontiers in Chemistry* 13 (13), 13

[72] Karami, F. (2026). A Systematic Review and Meta Analysis: Impact of Emergency Department Nursing Interventions on Patient Safety and Clinical Outcomes, *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 199-211.

[73] Karami, F. (2026). Effectiveness of Nurse Led Triage Interventions on Patient Outcomes in Emergency Departments: A Systematic Review and Meta Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 226-235.

[74] Khasawneh, H. E. N. , Ameer, S. A. , Qassem, L. Y. , Hussein, A. H. A. , Saud, H. R. , Idan, A. H. , Bahair, H. and Samimi, A. (2025). Examining the Design Parameters of Solvents of Carbon Dioxide Production Unit Using Diesel Combustion Method. *Iranian Journal of Chemistry and Chemical Engineering*, 44(1), 235-243.

[75] Khasawneh, H. E. N. , Ameer, S. A. , Qassem, L. Y. , Hussein, A. H. A. , Saud, H. R. , Idan, A. H. , Bahair, H. and Samimi, A. (2025). Examining the Design Parameters of Solvents of Carbon Dioxide Production Unit Using Diesel Combustion Method. *Iranian Journal of Chemistry and Chemical Engineering*, 44(1), 235-243.

[76] Khasawneh, HEN., (2025), Review of Studies on Refinery Unit Simulation, *Journal of Chemical Reviews* 7 (3), 512-530

[77] Khasawneh, HEN., et al., (2025), Unveiling the therapeutic potential of 1, 2, 4-oxadiazole derivatives: An updated review, *Results in Chemistry*, 102271

[78] Lotfi, A R and Nouri Bayat, L. (2026). Incidence of Postoperative Complications Following Nasal Fracture Surgery in Adults. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 175-182.

[79] Mehrasa, P and Eghdam Zamiri, R. (2026). Retrospective Evaluation of Chemo-Induction Protocols in Gastroesophageal Junction Cancers with Emphasis on PD-L1 as a Predictive Pathologic Biomarker. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 276-284.

[80] Mehrasa, P Eghdam Zamiri, R. (2026). Prognostic Value and Predictive Utility of CA15 3 and CRP as Pathophysiological Biomarkers in Patients with Breast Cancer Undergoing Chemotherapy. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 329-338.

[81] Moghadam, A M. (2025). Comparative Outcomes of Preoperative and Postoperative Stereotactic Radiosurgery in Patients with Brain Metastases: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 1(11), 392-402.

[82] Moghadam, A M. (2025). Effectiveness of Intraoperative Neuromonitoring in Preventing Neurological Complications during Cervical Spine Surgery: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 1(11), 378-386.

[83] Moghadam, A M. (2025). Effectiveness of Intraoperative Neuromonitoring in Preventing Neurological Complications during Cervical Spine Surgery: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 1(11), 403-411.

[84] Moghadam, A M. (2025). Efficacy and Safety of Minimally Invasive Versus Open Spinal Fusion Techniques for Spondylolisthesis: A Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 1(11), 370-377.

- [85] Moghadam, A M. (2026). Comparative Outcomes of Preoperative and Postoperative Stereotactic Radiosurgery in Patients Undergoing Resection for Brain Metastases: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(2), 137-146.
- [86] Moghadam, A M. (2026). Diagnostic and Prognostic Value of Circulating microRNAs in Adult and Pediatric Brain Tumors: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 156-167.
- [87] Moghadam, A M. (2026). Diagnostic and Prognostic Value of Circulating microRNAs in Adult Brain Tumors: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(1), 42-49.
- [88] Moghadam, A M. (2026). Diagnostic and Prognostic Value of Circulating microRNAs in Adult and Pediatric Brain Tumors: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 156-167.
- [89] Moghadam, A M. (2026). Fibrin-Based Hydrogels for Nerve Protection and Regeneration after Spinal Cord Injury: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(2), 106-116.
- [90] Moghadam, A M. (2026). Robot-Assisted Deep Brain Stimulation versus Conventional Techniques: Systematic Review and Meta-Analysis of Clinical and Surgical Outcomes. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(2), 147-155.
- [91] Mohammadzadeh Abachi, E and Montazer Babil Olyaei, M. (2026). Granulomatous Mastitis: A Systematic Review of Diagnosis and Management. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 141-149.
- [92] Mohammadzadeh Abachi, E and Montazer Babil Olyaei, M. (2026). Incidence of Re Expansion Pulmonary Edema During Chest Tube Placement Compared With Video Assisted Thoracoscopic Surgery in Massive Pleural Effusion. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 167-174.
- [93] Mohammadzadeh Abachi, E and Montazer Babil Olyaei, M. (2026). Neutrophil to Lymphocyte Ratio as a Diagnostic and Prognostic Biomarker for Complication Prediction in Acute Appendicitis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 134-140.
- [94] Rahmani, A and Abadi, P M S. (2026). Effectiveness of Skin Graft Fixation Techniques in Plastic Surgery: A Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 309-325.
- [95] Rahmani, A and Abadi, P M S. (2026). Efficacy of Negative Pressure Wound Therapy Compared to Conventional Wound Closure in Plastic and Reconstructive Surgery: A Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 383-396.
- [96] Rahmani, A and Abadi, P M S. (2026). Preventive Negative Pressure Wound Therapy versus Standard Postoperative Dressings in Plastic and Reconstructive Surgery: A Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 212-225.
- [97] Ranjkesh, M and Maroufi, P. (2026). The Value of Serial Radiography in the Long Term Follow Up of Patients After Total Knee Arthroplasty: A Systematic Perspective. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 150-156.
- [98] Rebut, F. (2026). Artificial Intelligence in Early Detection of Skin Cancer. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 236-250.
- [99] Rebut, F. (2026). The Impact of Oral Hygiene Practices on the Prevention of Periodontal Diseases. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 332-345.
- [100] Rebut, F. (2026). The Relationship between Oral Health and Systemic Diseases: A Comprehensive Review of Bidirectional Linkages and Pathophysiological Mechanisms. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 359-370.
- [101] Rebut, F. (2026). The Role of Saliva in Oral Health and Disease Diagnosis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 168-176.
- [102] Rezaei, M and Abedini, N. (2026). Prevalence of Acute Postoperative Pain and Its Associated Risk Factors in Patients Undergoing Laparoscopic Hysterectomy. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 251-258.
- [103] Rezaei, M and Dehghani, A. (2026). Association Between Age and the Incidence of Acute Postoperative Pain After Laparoscopic Hysterectomy. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 383-390.
- [104] Rezaei, M and Dehghani, A. (2026). The Effect of Dexmedetomidine on Preventing Postoperative Delirium by Modulating Tumor Necrosis Factor-Alpha (TNF- α) Levels in Patients Undergoing Esophagectomy. *Medicinal,*

Psychological, and Health Research Journal (MPHRJ), 2(5), 391-399.

[105] Rezaei, M and Owaysee Osquee, H. (2026). Prevalence of Deep Vein Thrombosis in Patients with COVID 19 Admitted to the Intensive Care Unit. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(4), 267-275.

[106] Sadeghzadeh, A. (2026). Adverse Events Associated with Facial Filler Injections: : A Systematic Review and Meta-analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 114-133.

[107] Sadeghzadeh, A. (2026). Effectiveness of Different Injection Depths for Facial Fillers: A Systematic Review and Meta-analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 157-166.

[108] Sadeghzadeh, A. (2026). Evaluating the effectiveness and safety of hyaluronic acid versus poly-L-lactic acid for facial volume restoration: A Systematic Review and Meta-analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(2), 102-113.

[109] Sadeghzadeh, A. (2026). Parametric Design and Personalized Facial Reconstruction: Lessons from Contemporary Architecture. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 296-308.

[110] salehitali, S , Hassanpour, A and Rahimi, K. (2026). The effectiveness of educational interventions based on the collaborative care model on treatment adherence in patients with chronic kidney failure undergoing hemodialysis: A clinical trial study. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 326-331.

[111] Samimi, A. Zarinabadi, S. (2011), Reduction of greenhouse gases emission and effect on environment, *Aust. j. basic appl. sci.*, 5(12), 752-756

[112] Samimi, A., Zarinabadi S., Shahbazi Kootenaee AH., Azimi A., Mirzaei M., (2019), Use of data mining in the corrosion classification of pipelines in catalytic reforming units (CRU), *Eura. Chem. Commu.*, 1(6), 571-581

[113] Samimi, A., Zarinabadi, S. (2012), Application solid polyurethane as coating in oil and gas pipelines, *Chisa*, 20th International Congress of Chemical and Process Engineering and 15th Conference Pres, 2012

[114] Samimi, A. (2025). Investigating the Effect of Temperature and Pressure Changes in CCR Unit Reactors on Catalyst Wear and Black Dust Increase. *Iranian Journal of Chemistry and Chemical Engineering*, 44(12), 3039-3051.

[115] Shiri, H and Ashrafi, N. (2026). Enhanced Recovery After Thoracotomy in the Intensive Care Unit: Current Evidence, Clinical Strategies, and

Future Perspectives. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 372-382.

[116] Shiri, H and Ashrafi, N. (2026). Post Esophageal Surgery Dysphagia and Nutritional Support in the Intensive Care Unit. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(5), 339-350.

[117] Sundaramurthy, S., Salam, J.J. Titinchi Abdal-Kareem M.A. Dawagreh, Mohammad M. Hailat, Al Khasawneh, H., (2019), STUDY OF THE PRESENCE OF METAL ELEMENTS IN SEA WATER IN THE STATE OF KUWAIT, *Ecology, Environment and Conservation*, 25,

[118] Zbuzant, M. (2026). Advances in Digital Dentistry Applications of CAD/CAM Technology. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 346-358.

[119] Zbuzant, M. (2026). Dental Implants vs. Traditional Bridges: A Comparative Clinical Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 189-198.

[120] Zbuzant, M. (2026). Early Detection of Oral Cancer: Diagnostic Methods and Challenges. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, 2(4), 371-382.

[121] Zbuzant, M. (2026). Minimally Invasive Techniques in Modern Restorative Dentistry. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, 2(3), 177-188.

[122] Hashemloo, A., Milanifard, M. (2025). Dermal Fillers: Types, Indications, and Complications Materials de Relleno: Typos, Indications Complications. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research*, 1(6), 161-170

[123] Hashemloo, A., Milanifard, M. (2025), Contouring Plus: A Comprehensive Approach of the Lower Third of the Face with Calcium Hydroxylapatite and Hyaluronic Acid, *Medicinal, Psychological, and Health Research Journal*, 1(5), 143-150