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DAFTAR PUSTAKA

Adochitei, A., & Drochioiu, G. (2011). Rapid characterization of peptide secondary structure by FT-IR spectroscopy. *Rev. Roum. Chim*, *56*(8), 783–791.

Aguilar-Marín, P., Angelats-Silva, L., Noriega-Diaz, E., Chavez-Bacilio, M., & Verde-Vera, R. (2020). Understanding the phenomenon of x-ray diffraction by crystals and related concepts. *European Journal of Physics*, *41*(4), 045501.

Ajala, E. O., Ajala, M. A., Ayinla, I. K., Sonusi, A. D., & Fanodun, S. E. (2020). Nano-synthesis of solid acid catalysts from waste-iron-filling for biodiesel production using high free fatty acid waste cooking oil. *Scientific Reports*, *10*(1), 13256.

Ajinkya, N., Yu, X., Kaithal, P., Luo, H., Somani, P., & Ramakrishna, S. (2020). Magnetic iron oxide nanoparticle (Ionp) synthesis to applications: Present and future. In *Materials* (Vol. 13, Number 20, pp. 1–35). MDPI AG. https://doi.org/10.3390/ma13204644

Albert, S., Albert, K. K., & Quack, M. (2011). High-resolution Fourier transform infrared spectroscopy. *Handbook of High-resolution Spectroscopy*.

Alfredo Reyes Villegas, V., Isaías De León Ramírez, J., Hernandez Guevara, E., Perez Sicairos, S., Angelica Hurtado Ayala, L., & Landeros Sanchez, B. (2020). Synthesis and characterization of magnetite nanoparticles for photocatalysis of nitrobenzene. *Journal of Saudi Chemical Society*, *24*(2), 223–235. https://doi.org/https://doi.org/10.1016/j.jscs.2019.12.004

Alipal, J., Pu'Ad, N. A. S. M., Lee, T. C., Nayan, N. H. M., Sahari, N., Basri, H., Idris, M. I., & Abdullah, H. Z. (2021). A review of gelatin: Properties, sources, process, applications, and commercialisation. *Materials Today: Proceedings*, *42*, 240–250.

Alvarez-Puebla, R. A., & Liz-Marzán, L. M. (2010). SERS-based diagnosis and biodetection. *Small*, *6*(5), 604–610.

Ansari, S. M., Sinha, B. B., Phase, D., Sen, D., Sastry, P. U., Kolekar, Y. D., & Ramana, C. V. (2019). Particle size, morphology, and chemical composition controlled CoFe2O4 nanoparticles with tunable magnetic properties via oleic acid based solvothermal synthesis for application in electronic devices. *ACS Applied Nano Materials*, *2*(4), 1828–1843.

Antarnusa, G., Esmawan, A., Dwi Jayanti, P., Rizki Fitriani, S., Suherman, A., Kinarya Palupi, E., Umam, R., & Ardimas. (2022). Synthesis of Fe_3O_4 at different reaction temperatures and investigation of its magnetic properties on giant magnetoresistance (GMR) sensors for bio-detection applications.

Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat /
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Journal of Magnetism and Magnetic Materials, *563*. https://doi.org/10.1016/j.jmmm.2022.169903

Antarnusa, G., & Suharyadi, E. (2020). A synthesis of polyethylene glycol (PEG)-coated magnetite Fe_3O_4 nanoparticles and their characteristics for enhancement of biosensor. *Materials Research Express*, *7*(5), 056103.

Araújo, E. V, Carneiro, S. V, Neto, D. M. A., Freire, T. M., Costa, V. M., Freire, R. M., Fechine, L., Clemente, C. S., Denardin, J. C., & Dos Santos, J. C. S. (2024). Advances in surface design and biomedical applications of magnetic nanoparticles. *Advances in Colloid and Interface Science*, 103166.

Ardiyanti, H., Mabarroh, N., Wibowo, N. A., Istiqomah, N. I., Tumbelaka, R. M., Ulil Absor, M. A., & Suharyadi, E. (2023). New design of a commercial chip-based GMR sensor with magnetite nanoparticles for biosensing applications. *Journal of Science: Advanced Materials and Devices*, *8*(2). https://doi.org/10.1016/j.jsamd.2023.100556

Arianna, F., Safriani, L., Kusumadewi, A. N., Gultom, N. S., Risdiana, & Saragi, T. (2025). In situ surface modification by oleic acid of magnetite nanoparticles: surface interaction, structure, and its magnetic properties. *Journal of Materials Science: Materials in Engineering*, *20*(1). https://doi.org/10.1186/s40712-025-00303-x

Atmono, T., & Yudho Pramono, E. (2014). Pengamatan Efek Giant Magnetoresistance Pada Multilayer Si (111)/Co/Cu Untuk Aplikasi Sensor Medan Magnet. *Prosiding Pertemuan Dan Presentasi Ilmiah–Penelitian Dasar Ilmu Pengetahuan Dan Teknologi Nuklir 2014*, 103–108.

Baabu, P. R. S., Kumar, H. K., Gumpu, M. B., Babu K, J., Kulandaisamy, A. J., & Rayappan, J. B. B. (2022). Iron oxide nanoparticles: a review on the province of its compounds, properties and biological applications. *Materials*, *16*(1), 59.

Bader, N., Benkhayal, A. A., & Zimmermann, B. (2014). Co-precipitation as a sample preparation technique for trace element analysis: an overview. *Int. J. Chem. Sci*, *12*(2), 519–525.

Bahadur, A., Saeed, A., Shoaib, M., Iqbal, S., Bashir, M. I., Waqas, M., Hussain, M. N., & Abbas, N. (2017). Eco-friendly synthesis of magnetite (Fe_3O_4) nanoparticles with tunable size: Dielectric, magnetic, thermal and optical studies. *Materials Chemistry and Physics*, *198*, 229–235. https://doi.org/10.1016/j.matchemphys.2017.05.061

Baibich, M. N., Broto, J. M., Fert, A., Van Dau, F. N., Petroff, F., Etienne, P., Creuzet, G., Friederich, A., & Chazelas, J. (1988). Giant magnetoresistance of (001) Fe/(001) Cr magnetic superlattices. *Physical Review Letters*, *61*(21), 2472.

UNIVERSITAS
GADJAH MADA
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Baldassarre, A., Mucci, N., Lecca, L. I., Tomasini, E., Parcias-do-Rosario, M. J., Pereira, C. T., Arcangeli, G., & Oliveira, P. A. B. (2020). Biosensors in occupational safety and health management: A narrative review. *International Journal of Environmental Research and Public Health*, *17*(7), 2461.

Barkay, T., Turner, R. R., Rasmussen, L. D., Kelly, C. A., & Rudd, J. W. M. (1998). Luminescence facilitated detection of bioavailable mercury in natural waters. *Bioluminescence Methods and Protocols*, 231–246.

Barnaś, J., & Dugaev, V. K. (2015). Giant magnetoresistance and applications. In *Handbook of Surface Science* (Vol. 5, pp. 371–419). Elsevier.

Barnaś, J., Fert, A., Gmitra, M., Weymann, I., & Dugaev, V. K. (2005). From giant magnetoresistance to current-induced switching by spin transfer. *Physical Review B*, *72*(2), 024426.

Bassim, S., Mageed, A. K., AbdulRazak, A. A., & Majdi, H. S. (2022). Green synthesis of Fe_3O_4 nanoparticles and its applications in wastewater treatment. *Inorganics*, *10*(12), 260.

Batlle, X., Moya, C., Escoda-Torroella, M., Iglesias, Ò., Rodríguez, A. F., & Labarta, A. (2022). Magnetic nanoparticles: From the nanostructure to the physical properties. *Journal of Magnetism and Magnetic Materials*, *543*, 168594.

Batta, I., Patial, R., Sobti, R. C., & Agrawal, D. K. (2024). Computational biology in the discovery of biomarkers in the diagnosis, treatment and management of cardiovascular diseases. *Cardiology and Cardiovascular Medicine*, *8*(5), 405.

Belouafa, S., Habti, F., Benhar, S., Belafkih, B., Tayane, S., Hamdouch, S., Bennamara, A., & Abourriche, A. (2017). Statistical tools and approaches to validate analytical methods: Methodology and practical examples. *International Journal of Metrology and Quality Engineering*, *8*. https://doi.org/10.1051/ijmqe/2016030

Berry, D. (2011). Fat's Balancing Act. *Food Product Design*, 1–4.

Bersweiler, M., Bender, P., Vivas, L. G., Albino, M., Petrecca, M., Mühlbauer, S., Erokhin, S., Berkov, D., Sangregorio, C., & Michels, A. (2019). Size-dependent spatial magnetization profile of manganese-zinc ferrite M n 0.2 Z n 0.2 F e 2.6 O 4 nanoparticles. *Physical Review B*, *100*(14), 144434.

Bhuiya, D. M. A. K., Muntaka, M., Nasrin, J., Madbar, S., Niva, M., Tabassum, S., Kazi, M., Hossain, R., Uddin, M. B., & Sakib, M. N. (2023). Enhancing Biomedical Potential: Comparative Analysis of Oleic Acid-Coated and Uncoated Iron Oxide Nanoparticles Through Synthesis and Characterization. *Available at SSRN 4572858*.

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Bianchetti, E., & Di Valentin, C. (2022). Mechanism of spin ordering in Fe_3O_4 nanoparticles by surface coating with organic acids. *Materials Today Nano*, *17*, 100169.

Bloemen, M., Brullot, W., Luong, T. T., Geukens, N., Gils, A., & Verbiest, T. (2012). Improved functionalization of oleic acid-coated iron oxide nanoparticles for biomedical applications. *Journal of Nanoparticle Research*, *14*, 1–10.

Botvin, V., Fetisova, A., Mukhortova, Y., Wagner, D., Kazantsev, S., Surmeneva, M., Kholkin, A., & Surmenev, R. (2023). Effect of Fe_3O_4 Nanoparticles Modified by Citric and Oleic Acids on the Physicochemical and Magnetic Properties of Hybrid Electrospun P(VDF-TrFE) Scaffolds. *Polymers*, *15*(14). https://doi.org/10.3390/polym15143135

Bunaciu, A. A., UdriŞTioiu, E. G., & Aboul-Enein, H. Y. (2015). X-ray diffraction: instrumentation and applications. *Critical Reviews in Analytical Chemistry*, *45*(4), 289–299.

Busch, S., Schwarz, U., & Kniep, R. (2003). Chemical and structural investigations of biomimetically grown fluorapatite–gelatin composite aggregates. *Advanced Functional Materials*, *13*(3), 189–198.

Buschow, K. H. J., & Boer, F. R. (2003). *Physics of magnetism and magnetic materials* (Vol. 7). Springer.

Cahyaningrum, R., Safira, K. K., Lutfiyah, G. N., Zahra, S. I., Rahasticha, A. A., & Aini, N. (2021). Potensi Gelatin Dari Berbagai Sumber Dalam Memperbaiki Karakteristik Marshmallow. *Pasundan Food Technology Journal (PFTJ)*, *8*(2), 39–44.

Caizer, C. (2016). Nanoparticle size effect on some magnetic properties. *Handbook of Nanoparticles*, *475*.

Cameron, J. M., Butler, H. J., Palmer, D. S., & Baker, M. J. (2018). Biofluid spectroscopic disease diagnostics: A review on the processes and spectral impact of drying. *Journal of Biophotonics*, *11*(4), e201700299.

Caraballo-Vivas, R. J. (2017). Magnetism from intermetallics and perovskite oxides. *ArXiv Preprint ArXiv:1707.09868*.

Chaki, S. H., Malek, T. J., Chaudhary, M. D., Tailor, J. P., & Deshpande, M. P. (2015). Magnetite Fe_3O_4 nanoparticles synthesis by wet chemical reduction and their characterization. *Advances in Natural Sciences: Nanoscience and Nanotechnology*, *6*(3), 035009.

Chambers, J. P., Arulanandam, B. P., Matta, L. L., Weis, A., & Valdes, J. J. (2008). Biosensor recognition elements. *Current Issues in Molecular Biology*, *10*(1–2), 1–12.

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Chan, K. L. A., & Kazarian, S. G. (2006). Detection of trace materials with Fourier transform infrared spectroscopy using a multi-channel detector. *Analyst*, *131*(1), 126–131.

Chen, F., Ilyas, N., Liu, X., Li, Z., Yan, S., & Fu, H. (2021). Size effect of Fe_3O_4 nanoparticles on magnetism and dispersion stability of magnetic nanofluid. *Frontiers in Energy Research*, *9*, 780008.

Chen, J., Liu, J., Yao, Y., & Chen, S. (2020). Effect of microstructural damage on the mechanical properties of silica nanoparticle-reinforced silicone rubber composites. *Engineering Fracture Mechanics*, *235*, 107195.

Chen, Y., Dong, Y., Yan, Z., Chen, D., Chen, Y., & Wang, L. (2017). Characteristic analysis of Fe_3O_4 nanoparticles modified by oleic acid and undecylenic acid. *Fullerenes, Nanotubes and Carbon Nanostructures*, *25*(6), 363–370. https://doi.org/10.1080/1536383X.2017.1310721

Chen, Y., Zou, C., Mastalerz, M., Hu, S., Gasaway, C., & Tao, X. (2015). Applications of micro-fourier transform infrared spectroscopy (FTIR) in the geological sciences—a review. *International Journal of Molecular Sciences*, *16*(12), 30223–30250.

Choi, J., Gani, A. W., Bechstein, D. J. B., Lee, J.-R., Utz, P. J., & Wang, S. X. (2016). Portable, one-step, and rapid GMR biosensor platform with smartphone interface. *Biosensors and Bioelectronics*, *85*, 1–7.

Choi, J. R., Yong, K. W., Choi, J. Y., & Cowie, A. C. (2019). Emerging point-of-care technologies for food safety analysis. *Sensors*, *19*(4), 817.

Coey, J. M. D. (2010). *Magnetism and magnetic materials*. Cambridge university press.

(CONTAM), E. P. on C. in the F. C. (2012). Scientific Opinion on the risk for public health related to the presence of mercury and methylmercury in food. *Efsa Journal*, *10*(12), 2985.

Corchero, J. L., & Villaverde, A. (2009). Biomedical applications of distally controlled magnetic nanoparticles. *Trends in Biotechnology*, *27*(8), 468–476.

Cotin, G., Piant, S., Mertz, D., Felder-Flesch, D., & Begin-Colin, S. (2018). Iron oxide nanoparticles for biomedical applications: Synthesis, functionalization, and application. In *Iron Oxide Nanoparticles for Biomedical Applications* (pp. 43–88). Elsevier.

Cubells-Beltrán, M.-D., Reig, C., Madrenas, J., De Marcellis, A., Santos, J., Cardoso, S., & Freitas, P. P. (2016). Integration of GMR sensors with different technologies. *Sensors*, *16*(6), 939.

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GADJAH MADA
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Cunha, D. R., Quinaz, M. B., & Segundo, M. A. (2026). Biopharmaceutical analysis—current analytical challenges, limitations, and perspectives. *Analytical and Bioanalytical Chemistry*, *418*(2), 373–394.

Dagotto, E., & Dagotto, E. (2003). Brief Introduction to Giant Magnetoresistance (GMR). *Nanoscale Phase Separation and Colossal Magnetoresistance: The Physics of Manganites and Related Compounds*, 395–405.

Dalmia, H., & Sinha, S. K. (2020). Analog to digital converters (ADC): A literature review. *E3S Web of Conferences*, *184*, 01025.

Danielli, C., van Langen, L., Boes, D., Asaro, F., Anselmi, S., Provenza, F., Renzi, M., & Gardossi, L. (2022). 2, 5-Furandicarboxaldehyde as a bio-based crosslinking agent replacing glutaraldehyde for covalent enzyme immobilization. *RSC Advances*, *12*(55), 35676–35684.

Daoush, W. M. (2017). Co-precipitation and magnetic properties of magnetite nanoparticles for potential biomedical applications. *J. Nanomed. Res*, *5*(3), 00118.

Dazzi, A., & Prater, C. B. (2017). AFM-IR: Technology and applications in nanoscale infrared spectroscopy and chemical imaging. *Chemical Reviews*, *117*(7), 5146–5173.

Desimoni, E., & Brunetti, B. (2015). About estimating the limit of detection by the signal to noise approach. *Pharmaceutica Analytica Acta*, *6*(3), 1–4.

Dey, P., Roy, J. N., Dey, P., & Roy, J. N. (2021). Giant Magnetoresistance (GMR). *Spintronics: Fundamentals and Applications*, 75–101.

Dieny, B., Speriosu, V. S., Parkin, S. S. P., Gurney, B. A., Wilhoit, D. R., & Mauri, D. (1991). Giant magnetoresistive in soft ferromagnetic multilayers. *Physical Review B*, *43*(1), 1297.

Dille, M. J., Haug, I. J., & Draget, K. I. (2021). Gelatin and collagen. In *Handbook of Hydrocolloids* (pp. 1073–1097). Elsevier.

Dincer, C., Bruch, R., Costa-Rama, E., Fernández-Abedul, M. T., Merkoçi, A., Manz, A., Urban, G. A., & Güder, F. (2019). Disposable sensors in diagnostics, food, and environmental monitoring. *Advanced Materials*, *31*(30), 1806739.

Djagny, K. B., Wang, Z., & Xu, S. (2001). Gelatin: a valuable protein for food and pharmaceutical industries. *Critical Reviews in Food Science and Nutrition*, *41*(6), 481–492.

Djamal, M., & Ramli, R. (2017). Giant magnetoresistance sensors based on ferrite material and its applications. *Magnetic Sensors—Development Trends and Applications*, 111–132.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Dodrill, B., & Lindemuth, J. R. (2021). Vibrating sample magnetometry. *Magnetic Measurement Techniques for Materials Characterization*, 15–37.

Doi, H., Watanabe, E., Shibata, H., & Tanabe, S. (2009). A reliable enzyme linked immunosorbent assay for the determination of bovine and porcine gelatin in processed foods. *Journal of Agricultural and Food Chemistry*, *57*(5), 1721–1726.

Dorset, D. L. (1995). *Structural electron crystallography*. Springer Science & Business Media.

Duconseille, A., Astruc, T., Quintana, N., Meersman, F., & Sante-Lhoutellier, V. (2015). Gelatin structure and composition linked to hard capsule dissolution: A review. *Food Hydrocolloids*, *43*, 360–376.

Dutta, A. (2017). Fourier transform infrared spectroscopy. *Spectroscopic Methods for Nanomaterials Characterization*, 73–93.

Dutz, S., Hergt, R., Mürbe, J., Müller, R., Zeisberger, M., Andrä, W., Töpfer, J., & Bellemann, M. E. (2007). Hysteresis losses of magnetic nanoparticle powders in the single domain size range. *Journal of Magnetism and Magnetic Materials*, *308*(2), 305–312.

Elahi, N., & Rizwan, M. (2021). Progress and prospects of magnetic iron oxide nanoparticles in biomedical applications: A review. *Artificial Organs*, *45*(11), 1272–1299.

Ennen, I., Kappe, D., Rempel, T., Glenske, C., & Hütten, A. (2016). Giant magnetoresistance: Basic concepts, microstructure, magnetic interactions and applications. *Sensors*, *16*(6), 904.

Feng, B., Hong, R. Y., Wang, L. S., Guo, L., Li, H. Z., Ding, J., Zheng, Y., & Wei, D. G. (2008). Synthesis of Fe_3O_4/APTES/PEG diacid functionalized magnetic nanoparticles for MR imaging. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, *328*(1–3), 52–59.

Feng, J., Yu, S., Li, J., Mo, T., & Li, P. (2016). Enhancement of the catalytic activity and stability of immobilized aminoacylase using modified magnetic Fe_3O_4 nanoparticles. *Chemical Engineering Journal*, *286*, 216–222.

Fiorillo, F. (2010). Measurements of magnetic materials. *Metrologia*, *47*(2), S114.

Forootan, A., Sjöback, R., Björkman, J., Sjögreen, B., Linz, L., & Kubista, M. (2017). Methods to determine limit of detection and limit of quantification in quantitative real-time PCR (qPCR). *Biomolecular Detection and Quantification*, *12*, 1–6.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Fortes, C. C. S., Daniel-da-Silva, A. L., Xavier, A. M. R. B., & Tavares, A. P. M. (2017). Optimization of enzyme immobilization on functionalized magnetic nanoparticles for laccase biocatalytic reactions. *Chemical Engineering and Processing: Process Intensification*, *117*, 1–8. https://doi.org/10.1016/j.cep.2017.03.009

Fraden, J. (2004). *Handbook of modern sensors: physics, designs, and applications*. Springer.

Ganapathe, L. S., Mohamed, M. A., Mohamad Yunus, R., & Berhanuddin, D. D. (2020). Magnetite (Fe_3O_4) nanoparticles in biomedical application: From synthesis to surface functionalisation. *Magnetochemistry*, *6*(4), 68.

Gangadi, J. R., Swain, K., & Pattnaik, S. (2025). Emerging Trends and Future Perspectives in Bioanalysis. *Bioanalytical Techniques: Principles and Applications*, 119–136.

Gauyacq, J.-P., Lorente, N., & Novaes, F. D. (2012). Excitation of local magnetic moments by tunneling electrons. *Progress in Surface Science*, *87*(5–8), 63–107.

Gharibzahedi, S. M. T., Barba, F. J., Mofid, V., & Altintas, Z. (2023). Biosensing technology in food production and processing. In *Advanced sensor technology* (pp. 743–824). Elsevier.

Ghazanfari, M. R., Kashefi, M., & Jaafari, M. R. (2016). Optimizing and modeling of effective parameters on the structural and magnetic properties of Fe_3O_4 nanoparticles synthesized by coprecipitation technique using response surface methodology. *Journal of Magnetism and Magnetic Materials*, *409*, 134–142.

Ghorpade, V. S. (2020). Preparation of hydrogels based on natural polymers via chemical reaction and cross-linking. In *Hydrogels based on natural polymers* (pp. 91–118). Elsevier.

Giannini, C., Ladisa, M., Altamura, D., Siliqi, D., Sibillano, T., & De Caro, L. (2016). X-ray diffraction: a powerful technique for the multiple-length-scale structural analysis of nanomaterials. *Crystals*, *6*(8), 87.

Givord, D., Rossignol, M., & Barthem, V. M. T. S. (2003). The physics of coercivity. *Journal of Magnetism and Magnetic Materials*, *258*, 1–5.

Glaser, C., Lattka, E., Rzehak, P., Steer, C., & Koletzko, B. (2011). Genetic variation in polyunsaturated fatty acid metabolism and its potential relevance for human development and health. *Maternal & Child Nutrition*, *7*, 27–40.

Gloag, L., Mehdipour, M., Chen, D., Tilley, R. D., & Gooding, J. J. (2019). Advances in the application of magnetic nanoparticles for sensing. *Advanced Materials*, *31*(48), 1904385.

UNIVERSITAS GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Goyal, R. N., & Shim, Y.-B. (2015). Glutaraldehyde sandwiched amino functionalized polymer based aptasensor for the determination and quantification of chloramphenicol. *RSC Advances*, *5*(85), 69356–69364.

Griffiths, D. J. (David J. (1999). *Introduction to electrodynamics*. Prentice Hall.

Guan, M., Mu, X., Zhang, H., Zhang, Y., Xu, J., Li, Q., Wang, X., Cao, D., & Li, S. (2019). Spindle-like Fe_3O_4 nanoparticles for improving sensitivity and repeatability of giant magnetoresistance biosensors. *Journal of Applied Physics*, *126*(6).

Guan, T., Ren, C., Feng, Y., Bian, C., Li, H., & Wang, Q. (2025). Construction and utilization of Fe_3O_4@ Al3+ immobilized laccase for enhancing organic diethylstilbestrol removal: A multi-spectroscopy and molecular docking investigation. *Computational and Structural Biotechnology Journal*.

Gunda, N. S. K., Singh, M., Norman, L., Kaur, K., & Mitra, S. K. (2014). Optimization and characterization of biomolecule immobilization on silicon substrates using (3-aminopropyl) triethoxysilane (APTES) and glutaraldehyde linker. *Applied Surface Science*, *305*, 522–530.

Gutfleisch, O., Willard, M. A., Brück, E., Chen, C. H., Sankar, S. G., & Liu, J. P. (2011). Magnetic materials and devices for the 21st century: stronger, lighter, and more energy efficient. *Advanced Materials*, *23*(7), 821–842.

Hafidz, M., Yaakob, C. M., Amin, I., & Noorfaizan, A. (2011). Chemical and functional properties of bovine and porcine skin gelatin. In *International Food Research Journal* (Vol. 18).

Halliday, D., Resnick, R., & Walker, J. (2013). *Fundamentals of physics*. John Wiley & Sons.

Han, M., Liang, D. F., & Deng, L. J. (2005). Sensors development using its unusual properties of Fe/Co-based amorphous soft magnetic wire. *Journal of Materials Science*, *40*, 5573–5580.

Harder, M., Gui, Y., & Hu, C.-M. (2016). Electrical detection of magnetization dynamics via spin rectification effects. *Physics Reports*, *661*, 1–59.

Harlina, P. W., Maritha, V., Geng, F., Nawaz, A., Yuliana, T., Subroto, E., Dahlan, H. J., Lembong, E., & Huda, S. (2024). Comprehensive review on the application of omics analysis coupled with Chemometrics in gelatin authentication of food and pharmaceutical products. *Food Chemistry: X*, *23*, 101710.

Harris, R. A., Shumbula, P. M., & van der Walt, H. (2015). Analysis of the interaction of surfactants oleic acid and oleylamine with iron oxide

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

nanoparticles through molecular mechanics modeling. *Langmuir*, *31*(13), 3934–3943.

Hassan, H. M., Souka, U. D., & Hassan, S. M. (2025). Differentiation and quantification of bovine and pork gelatin using UPLC-QTOF and ATR-FTIR spectroscopy: Addressing challenges in mixed gelatin analysis and detection. *Food Chemistry*, *464*, 141883.

Hassan, N., Ahmad, T., Zain, N. M., & Awang, S. R. (2021). Identification of bovine, porcine and fish gelatin signatures using chemometrics fuzzy graph method. *Scientific Reports*, *11*(1), 9793.

He, Q., Song, P., Zhang, Z., You, Z., & Tu, W. (2015). Preparation of magnetic gelatin-starch microspheres and adsorption performance for bovine serum album. *Journal of Central South University*, *22*, 1220–1226.

Henderson, L., Zamora, S., Ahmed, T. N., Belduque, C., Tate, J., Chen, M. Y., & Geerts, W. J. (2021). Altering magnetic properties of iron filament PLA using magnetic field assisted additive manufacturing (MFAAM). *Journal of Magnetism and Magnetic Materials*, *538*, 168320.

Heringa, M. F., Slowik, J. G., Goldmann, M., Signorell, R., Hemberger, P., & Bodi, A. (2017). The distant double bond determines the fate of the carboxylic group in the dissociative photoionization of oleic acid. *ChemPhysChem*, *18*(24), 3595–3604.

Hernández, B., Pflüger, F., Adenier, A., Kruglik, S. G., & Ghomi, M. (2010). Vibrational analysis of amino acids and short peptides in hydrated media. VIII. Amino acids with aromatic side chains: L-phenylalanine, L-tyrosine, and L-tryptophan. *The Journal of Physical Chemistry B*, *114*(46), 15319–15330.

Holder, C. F., & Schaak, R. E. (2019). Tutorial on powder X-ray diffraction for characterizing nanoscale materials. In *Acs Nano* (Vol. 13, Number 7, pp. 7359–7365). ACS Publications.

Hossain, M. K., Hasan, M. M., Islam, M. S., Mefford, O. T., Ahmad, H., & Rahman, M. M. (2024). Polypyrrole coating via lemieux-von rudloff oxidation on magnetite nanoparticles for highly efficient removal of chromium (VI) from wastewater. *ACS Omega*, *9*(17), 19077–19088.

Hott, M., Hoeher, P. A., & Reinecke, S. F. (2019). Magnetic communication using high-sensitivity magnetic field detectors. *Sensors*, *19*(15), 3415.

Houshiar, M., Zebhi, F., Razi, Z. J., Alidoust, A., & Askari, Z. (2014). Synthesis of cobalt ferrite ($CoFe_2O_4$) nanoparticles using combustion, coprecipitation, and precipitation methods: A comparison study of size, structural, and magnetic properties. *Journal of Magnetism and Magnetic Materials*, *371*, 43–48.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Howarter, J. A., & Youngblood, J. P. (2006). Optimization of silica silanization by 3-aminopropyltriethoxysilane. *Langmuir*, *22*(26), 11142–11147.

Huang, H. T., Garu, P., Li, C. H., Chang, W. C., Chen, B. W., Sung, S. Y., Lee, C. M., Chen, J. Y., Hsieh, T. F., & Sheu, W. J. (2019). Magnetoresistive biosensors for direct detection of magnetic nanoparticle conjugated biomarkers on a chip. *Spin*, *9*(02), 1940002.

Ijiri, Y., Poudel, C., Williams, P. S., Moore, L. R., Orita, T., & Zborowski, M. (2013). Inverted linear Halbach array for separation of magnetic nanoparticles. *IEEE Transactions on Magnetics*, *49*(7), 3449–3452.

Inaba, K., Kobayashi, S., Uehara, K., Okada, A., Reddy, S. L., & Endo, T. (2013). High Resolution X-Ray Diffraction Analyses of (La,Sr)MnO&lt ;sub> 3< /sub> /ZnO/Sapphire(0001) Double Heteroepitaxial Films. *Advances in Materials Physics and Chemistry*, *03*(01), 72–89. https://doi.org/10.4236/ampc.2013.31a010

Inkson, B. J. (2016). Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) for materials characterization. In *Materials characterization using nondestructive evaluation (NDE) methods* (pp. 17–43). Elsevier.

Iqbal, M. N., & Hady, H. (2016). Pembuatan Mikrokapsul Phycocyanin Menggunakan Maltodekstrin sebagai Bahan Pelapis dengan Metode Spray Drying. *Seminar Nasional Teknik Kimia" Kejuangan"*, 12.

Irfanita, N., Jaswir, I., Mirghani, M. E. S., Sukmasari, S., Ardini, Y. D., & Lestari, W. (2017). Rapid detection of gelatin in dental materials using attenuated total reflection fourier transform infrared spectroscopy (ATR-FTIR). *Journal of Physics: Conference Series*, *884*(1), 012090.

Irvan, M., Darmanto, Y. S., & Purnamayati, L. (2019). Pengaruh penambahan gelatin dari kulit ikan yang berbeda terhadap karakteristik chikuwa. *Jurnal Ilmu Pangan Dan Hasil Pertanian*, *3*(1), 78–93.

Issa, B., Obaidat, I. M., Albiss, B. A., & Haik, Y. (2013). Magnetic nanoparticles: surface effects and properties related to biomedicine applications. *International Journal of Molecular Sciences*, *14*(11), 21266–21305.

Izadiyan, Z., Shameli, K., Miyake, M., Teow, S.-Y., Peh, S.-C., Mohamad, S. E., & Taib, S. H. M. (2019). Green fabrication of biologically active magnetic core-shell Fe_3O_4/Au nanoparticles and their potential anticancer effect. *Materials Science and Engineering: C*, *96*, 51–57.

Jadhav, N. V, Prasad, A. I., Kumar, A., Mishra, R., Dhara, S., Babu, K. R., Prajapat, C. L., Misra, N. L., Ningthoujam, R. S., & Pandey, B. N. (2013). Synthesis of

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
Helendra, Prof. Dr. Harsojo, SU., M.Sc ; Prof. Dr.Eng. Edi Suharyadi, S.Si., M.Eng
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

oleic acid functionalized Fe_3O_4 magnetic nanoparticles and studying their interaction with tumor cells for potential hyperthermia applications. *Colloids and Surfaces B: Biointerfaces*, *108*, 158–168.

Jamshaid, T., Neto, E. T. T., Eissa, M. M., Zine, N., Kunita, M. H., El-Salhi, A. E., & Elaissari, A. (2016). Magnetic particles: From preparation to lab-on-a-chip, biosensors, microsystems and microfluidics applications. *TrAC Trends in Analytical Chemistry*, *79*, 344–362.

Jogschies, L., Klaas, D., Kruppe, R., Rittinger, J., Taptimthong, P., Wienecke, A., Rissing, L., & Wurz, M. C. (2015). Recent developments of magnetoresistive sensors for industrial applications. *Sensors*, *15*(11), 28665–28689.

Justus, J. S., Roy, S. D. D., Saravanakumar, K., & Raj, A. M. E. (2021). Judging phase purity of hematite (α-Fe_2O_3) nanoparticles through structural and magnetic studies. *Materials Research Express*, *8*(5), 055005.

Kanakaraj, T. M., Bhajantri, R. F., Chavan, C., Bulla, S., Anandalli, M., Pujar, M. S., & Jadhav, M. S. (2023). Synthesis and Characterization of Fe_3O_4-oleate/Poly (vinyl alcohol) Nanocomposites for Electrical Applications. *Indian Journal of Pure and Applied Physics*, *61*(8), 659–6780. https://doi.org/10.56042/ijpap.v61i8.952

Kang, Y., Shi, S., Sun, H., Dan, J., Liang, Y., Zhang, Q., Su, Z., Wang, J., & Zhang, W. (2022). Magnetic Nanoseparation Technology for Efficient Control of Microorganisms and Toxins in Foods: A Review. *Journal of Agricultural and Food Chemistry*, *70*(51), 16050–16068.

Käppler, A., Fischer, D., Oberbeckmann, S., Schernewski, G., Labrenz, M., Eichhorn, K. J., & Voit, B. (2016). Analysis of environmental microplastics by vibrational microspectroscopy: FTIR, Raman or both? *Analytical and Bioanalytical Chemistry*, *408*(29), 8377–8391. https://doi.org/10.1007/s00216-016-9956-3

Karim, A. A., & Bhat, R. (2008). Gelatin alternatives for the food industry: recent developments, challenges and prospects. *Trends in Food Science & Technology*, *19*(12), 644–656.

Karnaushenko, D., Makarov, D., Stöber, M., Karnaushenko, D. D., Baunack, S., & Schmidt, O. G. (2015). High-performance magnetic sensorics for printable and flexible electronics. *Advanced Materials*, *27*(5), 880–885.

Kaushik, A. M., Hsieh, K., & Wang, T. (2018). Droplet microfluidics for high-sensitivity and high-throughput detection and screening of disease biomarkers. *Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology*, *10*(6), e1522.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Kerenkan, A. E., Béland, F., & Do, T.-O. (2016). Chemically catalyzed oxidative cleavage of unsaturated fatty acids and their derivatives into valuable products for industrial applications: a review and perspective. *Catalysis Science & Technology*, *6*(4), 971–987.

Khan, M. A., Sun, J., Li, B., Przybysz, A., & Kosel, J. (2021). Magnetic sensors-A review and recent technologies. *Engineering Research Express*, *3*(2), 022005.

Kim, N. E., Park, S., Kim, S., Choi, J. H., Kim, S. E., Choe, S. H., Kang, T. woong, Song, J. E., & Khang, G. (2023). Development of Gelatin-Based Shape-Memory Polymer Scaffolds with Fast Responsive Performance and Enhanced Mechanical Properties for Tissue Engineering Applications. *ACS Omega*, *8*(7), 6455–6462. https://doi.org/10.1021/acsomega.2c06730

Kim, S. N., Choi, J. W., & Lim, S. H. (2019). Tailoring of magnetic properties of giant magnetoresistance spin valves via insertion of ultrathin non-magnetic spacers between pinned and pinning layers. *Scientific Reports*, *9*(1), 1617.

Kolhatkar, A. G., Jamison, A. C., Litvinov, D., Willson, R. C., & Lee, T. R. (2013). Tuning the magnetic properties of nanoparticles. *International Journal of Molecular Sciences*, *14*(8), 15977–16009.

Kong, J., & Yu, S. (2007). Fourier transform infrared spectroscopic analysis of protein secondary structures. *Acta Biochimica et Biophysica Sinica*, *39*(8), 549–559.

Kotoulas, K. T., Campbell, J., Skirtach, A. G., Volodkin, D., & Vikulina, A. (2022). Surface modification with particles coated or made of polymer multilayers. *Pharmaceutics*, *14*(11), 2483.

Kotresh, K. R., Neelagund, S. E., Mahesh, M. C., & Avinash, B. (2018). Immobilization of Hyperthermostable α-Amylase Using Magnetite [Fe_3O_4] Nano Particle to Promote the Properties for Industrial Applications. *Journal of Bionanoscience*, *12*(5), 664–670.

Koyani, R. D., Andrade, M., Quester, K., Gaytán, P., Huerta-Saquero, A., & Vazquez-Duhalt, R. (2018). Surface modification of protein enhances encapsulation in chitosan nanoparticles. *Applied Nanoscience*, *8*(5), 1197–1203.

Kramer, M. J., McCallum, R. W., Anderson, I. A., & Constantinides, S. (2012). Prospects for non-rare earth permanent magnets for traction motors and generators. *Jom*, *64*, 752–763.

Krishnan, K. M. (2016). *Fundamentals and applications of magnetic materials*. Oxford University Press.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
Helendra, Prof. Dr. Harsojo, SU., M.Sc ; Prof. Dr.Eng. Edi Suharyadi, S.Si., M.Eng
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Kromidas, S. (2016). *The HPLC expert: Possibilities and Limitations of Modern high performance liquid chromatography*. John Wiley & Sons.

Kumar, S., Kumar Bn, V., & Nongthomba, U. (n.d.). *Application of vibrational microspectroscopy to biology and medicine*. Retrieved https://www.researchgate.net/publication/231338007

Lai, C. W., Low, F. W., Tai, M. F., & Abdul Hamid, S. B. (2018). Iron oxide nanoparticles decorated oleic acid for high colloidal stability. *Advances in Polymer Technology*, *37*(6), 1712–1721.

Landoulsi, J., Genet, M. J., El Kirat, K., Richard, C., Pulvin, S., & Rouxhet, P. G. (2011). Silanization with APTES for controlling the interactions between stainless steel and biocomponents: reality vs expectation. *Biomaterials-Physics and Chemistry*, *5*, 99–126.

Lattuada, M., & Hatton, T. A. (2007). Functionalization of monodisperse magnetic nanoparticles. *Langmuir*, *23*(4), 2158–2168.

Lau, H. Y., & Botella, J. R. (2017). Advanced DNA-based point-of-care diagnostic methods for plant diseases detection. *Frontiers in Plant Science*, *8*, 2016.

Lavín, Á., Vicente, J. de, Holgado, M., Laguna, M. F., Casquel, R., Santamaría, B., Maigler, M. V., Hernández, A. L., & Ramírez, Y. (2018). On the determination of uncertainty and limit of detection in label-free biosensors. *Sensors*, *18*(7), 2038.

Lawrence, M. B., Ray, D., & Aswal, V. K. (2024). Effect of glutaraldehyde and carbonyl iron concentration on the structure of gelatin-based ferrogels. *Journal of Polymer Research*, *31*(6). https://doi.org/10.1007/s10965-024-03998-2

Lee, J.-H., Kim, M.-R., Jo, C.-H., Jung, Y.-K., Kwon, K., & Kang, T. S. (2016). Specific PCR assays to determine bovine, porcine, fish and plant origin of gelatin capsules of dietary supplements. *Food Chemistry*, *211*, 253–259.

Lesiak, B., Rangam, N., Jiricek, P., Gordeev, I., Tóth, J., Kövér, L., Mohai, M., & Borowicz, P. (2019). Surface Study of Fe_3O_4 Nanoparticles Functionalized With Biocompatible Adsorbed Molecules. *Frontiers in Chemistry*, *7*. https://doi.org/10.3389/fchem.2019.00642

Levy, D., Giustetto, R., & Hoser, A. (2012). Structure of magnetite (Fe_3O_4) above the Curie temperature: a cation ordering study. *Physics and Chemistry of Minerals*, *39*, 169–176.

Lewis, L. H., & Jiménez-Villacorta, F. (2013). Perspectives on permanent magnetic materials for energy conversion and power generation. *Metallurgical and Materials Transactions A*, *44*, 2–20.

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Li, K., Li, Z., Zhang, T., & Yang, X. (2020). High sensitivity, broad linearity range and low detection limit flexible pressure sensors based on irregular surface microstructure. *Organic Electronics*, *87*, 105920.

Li, L., Li, D., & Zhang, Z. (2022). Colloidal Stability of Magnetite Nanoparticles Coated by Oleic Acid and 3-(N,N-Dimethylmyristylammonio) propanesulfonate in Solvents. *Frontiers in Materials*, *Volume 9-2022*. https://www.frontiersin.org/ journals/ materials/ articles/ 10.3389/fmats.2022.893072

Li, L., Mak, K. Y., Leung, C. W., Ng, S. M., Lei, Z. Q., & Pong, P. W. T. (2013). Detection of 10-nm superparamagnetic iron oxide nanoparticles using exchange-biased GMR sensors in Wheatstone bridge. *IEEE Transactions on Magnetics*, *49*(7), 4056–4059.

Li, Q., Kartikowati, C. W., Horie, S., Ogi, T., Iwaki, T., & Okuyama, K. (2017). Correlation between particle size/domain structure and magnetic properties of highly crystalline Fe_3O_4 nanoparticles. *Scientific Reports*, *7*(1), 9894.

Liang, S., Sutham, P., Wu, K., Mallikarjunan, K., & Wang, J.-P. (2022). Giant magnetoresistance biosensors for food safety applications. *Sensors*, *22*(15), 5663.

Liang, Y. C., Chang, L., Qiu, W., Kolhatkar, A. G., Vu, B., Kourentzi, K., Lee, T. R., Zu, Y., Willson, R., & Litvinov, D. (2017). Ultrasensitive magnetic nanoparticle detector for biosensor applications. *Sensors (Switzerland)*, *17*(6). https://doi.org/10.3390/s17061296

Lien, G.-S., Liu, C.-W., Jiang, J.-A., Chuang, C.-L., & Teng, M.-T. (2012). Magnetic control system targeted for capsule endoscopic operations in the stomach—design, fabrication, and in vitro and ex vivo evaluations. *IEEE Transactions on Biomedical Engineering*, *59*(7), 2068–2079.

Lin, D., Feng, X., Wu, Y., Ding, B., Lu, T., Liu, Y., Chen, X., Chen, D., & Yang, C. (2018). Insights into the synergy between recyclable magnetic Fe_3O_4 and zeolite for catalytic aquathermolysis of heavy crude oil. *Applied Surface Science*, *456*, 140–146.

Lin, G., Makarov, D., & Schmidt, O. G. (2017). Magnetic sensing platform technologies for biomedical applications. *Lab on a Chip*, *17*(11), 1884–1912.

Lin, H., Bean, S. R., Tilley, M., Peiris, K. H. S., & Brabec, D. (2021). Qualitative and quantitative analysis of sorghum grain composition including protein and tannins using ATR-FTIR spectroscopy. *Food Analytical Methods*, *14*, 268–279.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
Helendra, Prof. Dr. Harsojo, SU., M.Sc ; Prof. Dr.Eng. Edi Suharyadi, S.Si., M.Eng
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Lin, J., Pan, D., Sun, Y., Ou, C., Wang, Y., & Cao, J. (2019). The modification of gelatin films: Based on various cross-linking mechanism of glutaraldehyde at acidic and alkaline conditions. *Food Science and Nutrition*, *7*(12), 4140–4146. https://doi.org/10.1002/fsn3.1282

Liu, D., Nikoo, M., Boran, G., Zhou, P., & Regenstein, J. M. (2015). Collagen and gelatin. *Annual Review of Food Science and Technology*, *6*, 527–557.

Liu, D.-M., Chen, J., & Shi, Y.-P. (2018). Advances on methods and easy separated support materials for enzymes immobilization. *TrAC Trends in Analytical Chemistry*, *102*, 332–342.

Liu, S., Yu, B., Wang, S., Shen, Y., & Cong, H. (2020). Preparation, surface functionalization and application of Fe_3O_4 magnetic nanoparticles. *Advances in Colloid and Interface Science*, *281*, 102165.

Liyanage, T., Qamar, A. Z., & Slaughter, G. (2020). Application of nanomaterials for chemical and biological sensors: A review. *IEEE Sensors Journal*, *21*(11), 12407–12425.

Lopez, J. A., González, F., Bonilla, F. A., Zambrano, G., & Gómez, M. E. (2010). Synthesis and characterization of Fe_3O_4 magnetic nanofluid. *Revista Latinoamericana de Metalurgia y Materiales*, *30*(1), 60–66.

Lowe, B. M., Sun, K., Zeimpekis, I., Skylaris, C.-K., & Green, N. G. (2017). Field-effect sensors–from pH sensing to biosensing: sensitivity enhancement using streptavidin–biotin as a model system. *Analyst*, *142*(22), 4173–4200.

Ma, C., Shao, H., Zhan, S., Hou, P., Zhang, X., Chai, Y., & Liu, H. (2019). Bi-phase dispersible Fe_3O_4@ Au core–shell multifunctional nanoparticles: Synthesis, characterization and properties. *Composite Interfaces*, *26*(6), 537–549.

Magnusson, R., Lee, K. J., Hemmati, H., Ko, Y. H., Wenner, B. R., Allen, J. W., Allen, M. S., Gimlin, S., & Weidanz, D. W. (2018). The guided-mode resonance biosensor: principles, technology, and implementation. *Frontiers in Biological Detection: From Nanosensors to Systems X*, *10510*, 46–54.

Mahdavi, M., Ahmad, M. Bin, Haron, M. J., Namvar, F., Nadi, B., Rahman, M. Z. A., & Amin, J. (2013). Synthesis, surface modification and characterisation of biocompatible magnetic iron oxide nanoparticles for biomedical applications. *Molecules*, *18*(7), 7533–7548.

Maqbool, Q., Jung, A., Won, S., Cho, J., Son, J. G., & Yeom, B. (2021). Chiral Magneto-Optical Properties of Supra-Assembled Fe_3O_4 Nanoparticles. *ACS Applied Materials and Interfaces*, *13*(45), 54301–54307. https://doi.org/10.1021/acsami.1c16954

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Marcon, P., & Ostanina, K. (2012). Overview of methods for magnetic susceptibility measurement. *PIERS Proceedings*.

Mardiansyah, D. (2013). Analisa sifat ferromagnetik material menggunakan metode monte carlo. *Edu Research*, *2*(2), 65–74.

Margariti, C. (2019). The application of FTIR microspectroscopy in a non-invasive and non-destructive way to the study and conservation of mineralised excavated textiles. *Heritage Science*, *7*, 1–14.

Marino, F., Lopez, E. R., Arnosa, A., Gómez, M. A. G., Pineiro, Y., Rivas, J., Alvarez-Lorenzo, C., & Fernandez, J. (2022). ZnO nanoparticles coated with oleic acid as additives for a polyalphaolefin lubricant. *Journal of Molecular Liquids*, *348*, 118401.

Mariyanto, M., Ramadhan, D. V., Purba, T. R., & Nabilah, F. A. (2022). Analysis of Vibrating Sample Magnetometer (VSM) data of Brantas river sediments using HYSITS. *Journal of Physics: Conference Series*, *2309*(1), 012025.

Masur, S., Zingsem, B., Marzi, T., Meckenstock, R., & Farle, M. (2016). Characterization of the oleic acid/iron oxide nanoparticle interface by magnetic resonance. *Journal of Magnetism and Magnetic Materials*, *415*, 8–12.

Matyi, R. J., Schwartz, L. H., & Butt, J. B. (1987). Particle size, particle size distribution, and related measurements of supported metal catalysts. *Catalysis Reviews Science and Engineering*, *29*(1), 41–99.

McCallum, R. W., Lewis, L. H., Skomski, R., Kramer, M. J., & Anderson, I. E. (2014). Practical aspects of modern and future permanent magnets. *Annual Review of Materials Research*, *44*, 451–477.

McHenry, M. E., & Laughlin, D. E. (2012). Magnetic moment and magnetization. *Characterization of Materials*, *2*.

Migneault, I., Dartiguenave, C., Bertrand, M. J., & Waldron, K. C. (2004). Glutaraldehyde: behavior in aqueous solution, reaction with proteins, and application to enzyme crosslinking. *Biotechniques*, *37*(5), 790–802.

Milani, J., & Maleki, G. (2012). Hydrocolloids in food industry. *Food Industrial Processes–Methods and Equipment*, *2*, 2–37.

Miller, J., & Miller, J. C. (2018). *Statistics and chemometrics for analytical chemistry*. Pearson education.

Miron, I. M., Garello, K., Gaudin, G., Zermatten, P.-J., Costache, M. V, Auffret, S., Bandiera, S., Rodmacq, B., Schuhl, A., & Gambardella, P. (2011).

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
Helendra, Prof. Dr. Harsojo, SU., M.Sc ; Prof. Dr.Eng. Edi Suharyadi, S.Si., M.Eng
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Perpendicular switching of a single ferromagnetic layer induced by in-plane current injection. *Nature*, *476*(7359), 189–193.

Morales, M. A., & Halpern, J. M. (2018). Guide to selecting a biorecognition element for biosensors. *Bioconjugate Chemistry*, *29*(10), 3231–3239.

Morgunov, R. B., Koplak, O. V, Allayarov, R. S., Kunitsyna, E. I., & Mangin, S. (2020). Effect of the stray field of Fe/ Fe_3O_4 nanoparticles on the surface of the CoFeB thin films. *Applied Surface Science*, *527*, 146836.

Mørup, S., Hansen, M. F., & Frandsen, C. (2010). Magnetic interactions between nanoparticles. In *Beilstein Journal of Nanotechnology* (Vol. 1, Number 1, pp. 182–190). https://doi.org/10.3762/bjnano.1.22

Mugnaini, G., Gelli, R., Mori, L., & Bonini, M. (2023). How to cross-link gelatin: The effect of glutaraldehyde and glyceraldehyde on the hydrogel properties. *ACS Applied Polymer Materials*, *5*(11), 9192–9202.

Murzin, D., Mapps, D. J., Levada, K., Belyaev, V., Omelyanchik, A., Panina, L., & Rodionova, V. (2020). Ultrasensitive magnetic field sensors for biomedical applications. *Sensors*, *20*(6), 1569.

Mustafa, M. A., Qasim, Q. A., Mahdi, A. B., Izzat, S. E., Alnassar, Y. S., Abood, E. S., alhakim, Z. J., Mahmoud, Z. H., Rheima, A. M., & Al-Salman, H. N. K. (2022). Supercapacitor Performance of Fe_3O_4 and Fe_3O_4@SiO2-bis(aminopyridine)-Cu Hybrid Nanocomposite. *International Journal of Electrochemical Science*, *17*(10), 221057. https://doi.org/https://doi.org/10.20964/2022.10.49

Muthukumaran, T., & Philip, J. (2016). Effect of phosphate and oleic acid capping on structure, magnetic properties and thermal stability of iron oxide nanoparticles. *Journal of Alloys and Compounds*, *689*, 959–968.

Nadeem, M., Shaheen, M., Zubair, M., Akhtar, M. S., Khalid, M., Javid, M. A., Sadiq, I., Mehmood Khan, H., & Zahra, S. (n.d.). *Synthesis and characterization of Oleic Acid Coated Fe_3O_4 Nanoparticles in Poly Alpha Olefin Oil based Nanofluid for Heat Transfer Applications*.

Naghib, S. M., Rahmanian, M., Majidzadeh-A, K., Asiaei, S., & Vahidi, O. (2016). Novel magnetic nanocomposites comprising reduced graphene oxide/Fe_3O_4/gelatin utilized in ultrasensitive non-enzymatic biosensing. *International Journal of Electrochemical Science*, *11*(12), 10256–10269.

Nair, S., Vataliya, S., Desai, D., & Lele, P. D. (2020). Designing of Digital Processing System Using ADS1115 and Arduinouno. *No. December*.

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Nalle, F. C., Wahid, R., Wulandari, I. O., & Sabarudin, A. (2019). Synthesis and characterization of magnetic Fe_3O_4 nanoparticles using oleic acid as stabilizing agent. *Rasayan J. Chem*, *12*(1), 14.

Nematidil, N., Sadeghi, M., Nezami, S., & Sadeghi, H. (2019). Synthesis and characterization of Schiff-base based chitosan-g-glutaraldehyde/NaMMTNPs-APTES for removal Pb2+ and Hg2+ ions. *Carbohydrate Polymers*, *222*, 114971.

Ng, E., Nadeau, K. C., & Wang, S. X. (2016). Giant magnetoresistive sensor array for sensitive and specific multiplexed food allergen detection. *Biosensors and Bioelectronics*, *80*, 359–365.

Nguyen, A. T., Hoang, Q. K., Nguyen, T. N., Nguyen, A. T., & Nguyen, T. A. (2018). Magnetoresistive performances in exchange-biased spin valves and their roles in low-field magnetic sensing applications. *Journal of Science: Advanced Materials and Devices*, *3*(4), 399–405.

Nguyen, M. D., Tran, H.-V., Xu, S., & Lee, T. R. (2021). Fe_3O_4 Nanoparticles: Structures, synthesis, magnetic properties, surface functionalization, and emerging applications. *Applied Sciences*, *11*(23), 11301.

Noor, N. Q. I. M., Razali, R. S., Ismail, N. K., Ramli, R. A., Razali, U. H. M., Bahauddin, A. R., Zaharudin, N., Rozzamri, A., Bakar, J., & Shaarani, S. M. (2021). Application of green technology in gelatin extraction: A review. *Processes*, *9*(12), 2227.

Noqta, O. A., Sodipo, B. K., & Aziz, A. A. (2020). One-pot synthesis of highly magnetic and stable citrate coated superparamagnetic iron oxide nanoparticles by modified coprecipitation method. *Functional Composites and Structures*, *2*(4), 045005.

Novoselova, L. Y. (2017). Hematite nanoparticle clusters with remarkably high magnetization synthesized from water-treatment waste by one-step “sharp high-temperature dehydration.” *RSC Advances*, *7*(81), 51298–51302.

NVE Corporation. (2025). *AA/AB-Series Analog Magnetic Sensors AA/AB-Series Analog Magnetic Sensors Equivalent Circuit*. www.nve.com

Obaidat, I. M., Issa, B., & Haik, Y. (2014). Magnetic properties of magnetic nanoparticles for efficient hyperthermia. In *Nanomaterials* (Vol. 5, Number 1, pp. 63–89). MDPI AG. https://doi.org/10.3390/nano5010063

Oliveira, D., Pinheiro, J., Neto, L., Pinto, V. H., & Gonçalves, G. (2022). A plug-and-play solution for smart transducers in industrial applications based on IEEE 1451 and IEC 61499 standards. *Sensors*, *22*(19), 7694.

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Osman, N. S. E., & Moyo, T. (2016). Temperature dependence of coercivity and magnetization of Sr 1/3 Mn 1/3 Co 1/3 Fe 2 O 4 ferrite nanoparticles. *Journal of Superconductivity and Novel Magnetism*, *29*, 361–366.

Peddis, D., Jönsson, P. E., Laureti, S., & Varvaro, G. (2014). Magnetic interactions: a tool to modify the magnetic properties of materials based on nanoparticles. In *Frontiers of nanoscience* (Vol. 6, pp. 129–188). Elsevier.

Petrescu, L.-G., Petrescu, M.-C., Ioniță, V., Cazacu, E., & Constantinescu, C.-D. (2019). Magnetic properties of manganese-zinc soft ferrite ceramic for high frequency applications. *Materials*, *12*(19), 3173.

Polichetti, M., Modestino, M., Galluzzi, A., Pace, S., Iuliano, M., Ciambelli, P., & Sarno, M. (2020). Influence of citric acid and oleic acid coating on the dc magnetic properties of Fe_3O_4 magnetic nanoparticles. *Materials Today: Proceedings*, *20*, 21–24.

Pratiwi, W., Fuada, S., Zanah, F. W., & Restyasari, N. (2021). Analisis rangkaian wheatstone bridge menggunakan simulator circuit wizard, proteus, dan multisim. *Telecommunications, Networks, Electronics, and Computer Technologies (TELNECT)*, *1*(1), 1–13.

Prayoga, G. A., Oktarisa, Y., Antarnusa, G., Fitriani, N. S., Aryani, R. M., Suherman, A., & Guntara, Y. (2024). *The Effect of Chitosan Addition on Phase Composition and Detection Sensitivity of Fe_3O_4/Chitosan Magnetic Label Nanoparticles Based on Giant Magnetoresistance Sensor*.

Prokopová, A., Gál, R., Mokrejš, P., & Pavlačková, J. (2023). Preparation of Gelatin from Broiler Chicken Stomach Collagen. *Foods*, *12*(1). https://doi.org/10.3390/foods12010127

Qi, Y., Luo, Q., Shen, J., Zheng, L., Zhou, J., & Chen, W. (2017). Surface modification of BMN particles with silane coupling agent for composites with PTFE. *Applied Surface Science*, *414*, 147–152.

Radoń, A., Drygała, A., Hawełek, Ł., & Łukowiec, D. (2017). Structure and optical properties of Fe_3O_4 nanoparticles synthesized by co-precipitation method with different organic modifiers. *Materials Characterization*, *131*, 148–156. https://doi.org/10.1016/j.matchar.2017.06.034

Rahayu, L. B. H., Wulandari, I. O., Santjojo, D. H., & Sabarudin, A. (2018). Synthesis and characterization of Fe_3O_4 nanoparticles using polyvinyl alcohol (PVA) as capping agent and glutaraldehyde (GA) as crosslinker. *IOP Conference Series: Materials Science and Engineering*, *299*(1), 012062.

Rahman, A. (2022). *Fundamentals of Magnetism and Spintronics*. Zorba Books.

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Rangel, W. M., Santa, R. A. A. B., & Riella, H. G. (2020). A facile method for synthesis of nanostructured copper (II) oxide by coprecipitation. *Journal of Materials Research and Technology*, *9*(1), 994–1004.

Raposo, F. (2016). Evaluation of analytical calibration based on least-squares linear regression for instrumental techniques: A tutorial review. *TrAC Trends in Analytical Chemistry*, *77*, 167–185.

Reig, C., Cubells-Beltrán, M.-D., & Muñoz, D. R. (2009). Magnetic field sensors based on giant magnetoresistance (GMR) technology: Applications in electrical current sensing. *Sensors*, *9*(10), 7919–7942.

Rieger, G., Ludwig, K., Hauch, J., & Clemens, W. (2001). GMR sensors for contactless position detection. *Sensors and Actuators A: Physical*, *91*(1–2), 7–11.

Riehemann, K., Schneider, S. W., Luger, T. A., Godin, B., Ferrari, M., & Fuchs, H. (2009). Nanomedicine—challenge and perspectives. *Angewandte Chemie International Edition*, *48*(5), 872–897.

Rifai, M., Yunasfi, Y., Sukirman, E., Sarwanto, Y., & Mujamilah, M. (2021). Structure and Magnetic Properties Of Fe/Si Nanoparticles Prepared by High Energy Milling Process. *Indonesian Journal of Applied Physics*, *11*(2), 239–247.

Rivani, D. A., Retnosari, I., & Saraswati, T. E. (2019). Influence of TiO2 addition on the magnetic properties of carbon-based iron oxide nanocomposites synthesized using submerged arc-discharge. *IOP Conference Series: Materials Science and Engineering*, *509*(1), 012034.

Rizzi, G., Lee, J.-R., Guldberg, P., Dufva, M., Wang, S. X., & Hansen, M. F. (2017). Denaturation strategies for detection of double stranded PCR products on GMR magnetic biosensor array. *Biosensors and Bioelectronics*, *93*, 155–160.

Rocha-Santos, T. A. P. (2014). Sensors and biosensors based on magnetic nanoparticles. *TrAC Trends in Analytical Chemistry*, *62*, 28–36.

Saber, M. M. (2019). Strategies for surface modification of gelatin-based nanoparticles. *Colloids and Surfaces B: Biointerfaces*, *183*, 110407.

Sajanlal, P. R., Sreeprasad, T. S., Samal, A. K., & Pradeep, T. (2011). Anisotropic nanomaterials: structure, growth, assembly, and functions. *Nano Reviews*, *2*(1), 5883.

Salvador, M., Moyano, A., Martínez-García, J. C., Blanco-López, M. C., & Rivas, M. (2019). Synthesis of Superparamagnetic Iron Oxide Nanoparticles: SWOT Analysis Towards Their Conjugation to Biomolecules for Molecular

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Recognition Applications. *Journal of Nanoscience and Nanotechnology*, *19*(8), 4839–4856. https://doi.org/10.1166/jnn.2019.16931

Schwaminger, S. P., Bauer, D., & Fraga-García, P. (2021). Gold-iron oxide nanohybrids: Insights into colloidal stability and surface-enhanced Raman detection. *Nanoscale Advances*, *3*(22), 6438–6445.

Segneanu, A. E., Gozescu, I., Dabici, A., Sfirloaga, P., & Szabadai, Z. (2012). *Organic compounds FT-IR spectroscopy* (Vol. 145). InTech Rijeka, Croatia.

Sequeira, M. P. F. (2022). *X-ray Diffraction: Principle and Applications*.

Shabatina, T. I., Vernaya, O. I., Shabatin, V. P., & Melnikov, M. Y. (2020). Magnetic nanoparticles for biomedical purposes: Modern trends and prospects. *Magnetochemistry*, *6*(3), 30.

Shabir, G. A. (2006). Method development and validation for the HPLC assay of hydrolysed gelatine. *Journal of Liquid Chromatography & Related Technologies*, *29*(9), 1257–1270.

Sharma, K. S., Ningthoujam, R. S., Dubey, A. K., Chattopadhyay, A., Phapale, S., Juluri, R. R., Mukherjee, S., Tewari, R., Shetake, N. G., & Pandey, B. N. (2018). Synthesis and characterization of monodispersed water dispersible Fe_3O_4 nanoparticles and in vitro studies on human breast carcinoma cell line under hyperthermia condition. *Scientific Reports*, *8*(1), 14766.

Sharma, R., Bisen, D. P., Shukla, U., & Sharma, B. G. (2012). X-ray diffraction: a powerful method of characterizing nanomaterials. *Recent Res Sci Technol*, *4*(8), 77–79.

Sharma, S., Zapatero-Rodríguez, J., Estrela, P., & O'Kennedy, R. (2015). Point-of-care diagnostics in low resource settings: present status and future role of microfluidics. *Biosensors*, *5*(3), 577–601.

Sinha, S., Sharma, R., Ansari, M. R., Singh, R., Pathak, S., Jahan, N., & Peta, K. R. (2025). Multifunctional oleic acid functionalized iron oxide nanoparticles for antibacterial and dye degradation applications with magnetic recycling. *Materials Advances*, *6*(7), 2253–2268. https://doi.org/10.1039/d5ma00036j

Sirivat, A., & Paradee, N. (2019). Facile synthesis of gelatin-coated Fe_3O_4 nanoparticle: Effect of pH in single-step co-precipitation for cancer drug loading. *Materials & Design*, *181*, 107942.

Skomski, R., Manchanda, P., Kumar, P., Balamurugan, B., Kashyap, A., & Sellmyer, D. J. (2013). Predicting the future of permanent-magnet materials. *IEEE Transactions on Magnetics*, *49*(7), 3215–3220.

UNIVERSITAS
GADJAH MADA
**Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat /
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Skomurski, F. N., Kerisit, S., & Rosso, K. M. (2010). Structure, charge distribution, and electron hopping dynamics in magnetite (Fe_3O_4)(1 0 0) surfaces from first principles. *Geochimica et Cosmochimica Acta*, *74*(15), 4234–4248.

Soares, P. I. P., Laia, C. A. T., Carvalho, A., Pereira, L. C. J., Coutinho, J. T., Ferreira, I. M. M., Novo, C. M. M., & Borges, J. P. (2016). Iron oxide nanoparticles stabilized with a bilayer of oleic acid for magnetic hyperthermia and MRI applications. *Applied Surface Science*, *383*, 240–247.

Song, M., Lin, X., Peng, Z., Xu, S., Jin, L., Zheng, X., & Luo, H. (2021). Materials and methods of biosensor interfaces with stability. *Frontiers in Materials*, *7*, 583739.

Spencer, M. E., Leahy, R. M., Mosher, J. C., & Lewis, P. S. (1992). Adaptive filters for monitoring localized brain activity from surface potential time series. *Asilomar Conference On Signals Systems And Computers*, 156.

Spivakov, A., Lin, C. R., Chang, Y. C., Wang, C. C., & Sarychev, D. (2020). Magnetic and magneto-optical oroperties of iron oxides nanoparticles synthesized under atmospheric pressure. *Nanomaterials*, *10*(9), 1–14. https://doi.org/10.3390/nano10091888

Stevens, P. (2009). Gelatine. *Food Stabilisers, Thickeners and Gelling Agents*, 116–144.

Suharyadi, E., Alfansuri, T., Handriani, L. S., Wibowo, N. A., & Sabarman, H. (2021). Detection of Fe_3O_4/PEG nanoparticles using one and two spin-valve GMR sensing elements in wheatstone bridge circuit. *Journal of Materials Science: Materials in Electronics*, *32*(19), 23958–23967.

Suharyadi, E., Pardede, I., & Hasibuan, F. A. (2016). Giant magnetoresistance (GMR) sensors based on Co/Cu multilayers for biomaterial detection applications. *2016 Progress in Electromagnetic Research Symposium (PIERS)*, 566–571.

Sukprasert, J., Thumanu, K., Phung-on, I., Jirarungsatean, C., Chaisalee, P., Tuitemwong, P., & Tuitemwong, K. (2021). Characterization of amino-functionalized ferromagnetic nanoparticles with glutaraldehyde cross-linking. *Journal of Science and Technology*, *13*(1), 38–46.

Sung Lee, J., Myung Cha, J., Young Yoon, H., Lee, J.-K., & Keun Kim, Y. (2015). Magnetic multi-granule nanoclusters: A model system that exhibits universal size effect of magnetic coercivity. *Scientific Reports*, *5*(1), 12135.

Supriadi, A., Saputra, D., Priyanto, G., Lidiasari, E., Nurhasanah, S., & Purwanto, S. (2023). *Evaluating Tyndallisation's potential for composite food products and quality considerations*.

UNIVERSITAS
GADJAH MADA
**Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat /
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Susanti, N., & Suharyadi, E. (2015). Analisa Magnetoresistance Berbasis Lapisan Tipis Giant Magnetoresistance (GMR) Pada Nanopartikel Cobalt Ferrite ($CoFe_2O_4$) Dilapisi Polyethylen Glicol (PEG). *Jurnal Fisika Indonesia*, *20*(1), 6–13.

Sypabekova, M., Hagemann, A., Rho, D., & Kim, S. (2022). 3-Aminopropyltriethoxysilane (APTES) deposition methods on oxide surfaces in solution and vapor phases for biosensing applications. *Biosensors*, *13*(1), 36.

Takai, Z. I., Mustafa, M. K., Asman, S., & Sekak, K. A. (2019). Preparation and Characterization of Magnetite (Fe_3O_4) nanoparticles By Sol-Gel Method. In *International Journal of Nanoelectronics and Materials* (Vol. 12, Number 1).

Tang, C., He, Z., Liu, H., Xu, Y., Huang, H., Yang, G., Xiao, Z., Li, S., Liu, H., & Deng, Y. (2020). Application of magnetic nanoparticles in nucleic acid detection. *Journal of Nanobiotechnology*, *18*(1), 1–19.

Thakur, G., Mitra, A., Basak, A., & Sheet, D. (2012). Characterization and scanning electron microscopic investigation of crosslinked freeze dried gelatin matrices for study of drug diffusivity and release kinetics. *Micron*, *43*(2–3), 311–320.

Upadhyay, S., Parekh, K., & Pandey, B. (2016). Influence of crystallite size on the magnetic properties of Fe_3O_4 nanoparticles. *Journal of Alloys and Compounds*, *678*, 478–485.

Urian, Y. A., Atoche-Medrano, J. J., Quispe, L. T., Félix, L. L., & Coaquira, J. A. H. (2021). Study of the surface properties and particle-particle interactions in oleic acid-coated Fe_3O_4 nanoparticles. *Journal of Magnetism and Magnetic Materials*, *525*, 167686.

Usman, M., Byrne, J. M., Chaudhary, A., Orsetti, S., Hanna, K., Ruby, C., Kappler, A., & Haderlein, S. B. (2018). Magnetite and green rust: synthesis, properties, and environmental applications of mixed-valent iron minerals. *Chemical Reviews*, *118*(7), 3251–3304.

Vainshtein, B. K. (2013). *Structure analysis by electron diffraction*. Elsevier.

Veiseh, O., Gunn, J. W., & Zhang, M. (2010). Design and fabrication of magnetic nanoparticles for targeted drug delivery and imaging. *Advanced Drug Delivery Reviews*, *62*(3), 284–304.

Vogel, M. (2009). The anomalous magnetic moment of the electron. *Contemporary Physics*, *50*(3), 437–452.

Wang, C., Ye, M., Zhang, X., Chai, X., Yu, H., Liu, B., Zhang, C., & Wang, Y. (2025). Aptamer-Based Biosensors for Rapid Detection and Early Warning of

UNIVERSITAS GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Food Contaminants: From Selection to Field Applications. *Molecules*, *30*(22), 4332.

Wang, K. (2011). Enzyme immobilization on chitosan-based supports. *Chitosan-Based Hydrogels*, *18*, 339–406.

Wang, S. X., & Li, G. (2008). Advances in giant magnetoresistance biosensors with magnetic nanoparticle tags: Review and outlook. *IEEE Transactions on Magnetics*, *44*(7), 1687–1702.

Wang, W., Wang, Y., Tu, L., Klein, T., Feng, Y., Li, Q., & Wang, J.-P. (2014). Magnetic detection of mercuric ion using giant magnetoresistance-based biosensing system. *Analytical Chemistry*, *86*(8), 3712–3716.

Wibowo, N. A., Juharni, J., Alfansuri, T., Handriani, L. S., Sabarman, H., & Suharyadi, E. (2020). Core-shell Fe_3O_4@ Ag magnetic nanoparticles detection using spin-valve GMR sensing element in the wheatstone bridge circuit. *Materials Research Express*, *7*(12), 126102.

Wibowo, N. A., Kurniawan, C., Kusumahastuti, D. K. A., Setiawan, A., & Suharyadi, E. (2024). Potential of tunneling magnetoresistance coupled to iron oxide nanoparticles as a novel transducer for biosensors-on-chip. *Journal of The Electrochemical Society*, *171*(1), 017512.

Wibowo, N. A., Sabarman, H., & Suharyadi, E. (2022). A new platform of iron oxide-based nanoparticles assay using GMR chip-based sensor with microcontroller. *IEEE Sensors Journal*, *22*(21), 20093–20101.

Wijaya, H., Syamsul, E. S., Octavia, D. R., Mardiana, L., Sentat, T., Rusnaeni, R., Mayefis, D., Helmidanora, R., Mentari, I. A., & Hanifa, D. N. C. (2023). *Farmasetika: Dasar-Dasar Ilmu Farmasi*. PT. Sonpedia Publishing Indonesia.

Williams, D. B., Carter, C. B., Williams, D. B., & Carter, C. B. (1996). *The transmission electron microscope*. Springer.

Wisdawati, D. F., Fuada, S., & Hasugian, L. P. (2025). Analisis Rangkaian Jembatan Wheatstone Dengan Pendekatan Teoretis Dan Simulasi. *Jurnal Kajian Teknik Elektro*, *10*(1), 12–19.

Wu, K., Klein, T., Krishna, V. D., Su, D., Perez, A. M., & Wang, J.-P. (2017). Portable GMR handheld platform for the detection of influenza A virus. *ACS Sensors*, *2*(11), 1594–1601.

Wu, K., Su, D., Saha, R., & Wang, J. (2022). Giant magnetoresistance (GMR) materials and devices for biomedical and industrial applications. *Spintronics: Materials, Devices and Applications*, 3–49.

UNIVERSITAS
GADJAH MADA
**Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat /
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Wu, K., Tonini, D., Liang, S., Saha, R., Chugh, V. K., & Wang, J. P. (2022). Giant Magnetoresistance Biosensors in Biomedical Applications. In *ACS Applied Materials and Interfaces* (Vol. 14, Number 8, pp. 9945–9969). American Chemical Society. https://doi.org/10.1021/acsami.1c20141

Wu, W., Wu, Z., Yu, T., Jiang, C., & Kim, W.-S. (2015). Recent progress on magnetic iron oxide nanoparticles: synthesis, surface functional strategies and biomedical applications. *Science and Technology of Advanced Materials*, *16*(2), 023501.

Xu, J., Jiao, J., Li, Q., & Li, S. (2017). Ultralow detection limit of giant magnetoresistance biosensor using Fe_3O_4 graphene composite nanoparticle label. *Chinese Physics B*, *26*(1), 010701.

Xu, J., Li, Q., Zong, W., Zhang, Y., & Li, S. (2016). Ultra-wide detectable concentration range of GMR biosensors using Fe_3O_4 microspheres. *Journal of Magnetism and Magnetic Materials*, *417*, 25–29.

Yang, H., Yang, S., Kong, J., Dong, A., & Yu, S. (2015). Obtaining information about protein secondary structures in aqueous solution using Fourier transform IR spectroscopy. *Nature Protocols*, *10*(3), 382–396.

Yang, Y., Li, L., Wang, H., Liu, M., & Wu, Y. (2020). Development and verification of a quantitative real-time PCR method to identify and quantify gelatin derived from animal hide. *Journal of Food Science*, *85*(9), 2762–2772.

Yao, J., Li, P., Li, L., & Yang, M. (2018). Biochemistry and biomedicine of quantum dots: from biodetection to bioimaging, drug discovery, diagnostics, and therapy. *Acta Biomaterialia*, *74*, 36–55.

Yasmin, J., Ahmed, M. R., & Cho, B.-K. (2016). Biosensors and their applications in food safety: a review. *Journal of Biosystems Engineering*, *41*(3), 240–254.

Yeap, S. P., Lim, J., Ooi, B. S., & Ahmad, A. L. (2017). Agglomeration, colloidal stability, and magnetic separation of magnetic nanoparticles: collective influences on environmental engineering applications. *Journal of Nanoparticle Research*, *19*, 1–15.

Yew, Y. P., Shameli, K., Miyake, M., Kuwano, N., Bt Ahmad Khairudin, N. B., Bt Mohamad, S. E., & Lee, K. X. (2016). Green Synthesis of Magnetite (Fe_3O_4) Nanoparticles Using Seaweed (Kappaphycus alvarezii) Extract. *Nanoscale Research Letters*, *11*(1). https://doi.org/10.1186/s11671-016-1498-2

Yoon, J., Shin, M., Lee, T., & Choi, J.-W. (2020). Highly sensitive biosensors based on biomolecules and functional nanomaterials depending on the types of nanomaterials: A perspective review. *Materials*, *13*(2), 299.

UNIVERSITAS
GADJAH MADA
Pengembangan Alat Deteksi Gelatin Berbasis Platform GMR Dengan Menggunakan Fe3O4@Asam Oleat / Glutaraldehyde Sebagai Pelabel
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Yu, R. H., Basu, S., Ren, L., Zhang, Y., Parvizi-Majidi, A., Unruh, K. M., & Xiao, J. Q. (2000). High temperature soft magnetic materials: FeCo alloys and composites. *IEEE Transactions on Magnetics*, *36*(5), 3388–3393.

Zhang, P., Thiyagarajah, N., & Bae, S. (2010). Magnetically labeled GMR biosensor with a single immobilized ferrimagnetic particle agent for the detection of extremely low concentration of biomolecules. *IEEE Sensors Journal*, *11*(9), 1927–1934.

Zhang, Y., Xu, J., Cao, D., Li, Q., Zhao, G., Sun, N. X., & Li, S. (2018). The influence of bias magnetization of nanoparticles on GMR sensor signal and sensitivity for the ultra-low concentration detection. *Journal of Magnetism and Magnetic Materials*, *453*, 132–136.

Zhang, Y., Xu, J., Li, Q., Cao, D., & Li, S. (2019). The effect of the particle size and magnetic moment of the Fe_3O_4 superparamagnetic beads on the sensitivity of biodetection. *AIP Advances*, *9*(1).

Zhang, Z., Vaisocherová, H., Cheng, G., Yang, W., Xue, H., & Jiang, S. (2008). Nonfouling behavior of polycarboxybetaine-grafted surfaces: structural and environmental effects. *Biomacromolecules*, *9*(10), 2686–2692.

Zhao, Z., Cui, H., Song, W., Ru, X., Zhou, W., & Yu, X. (2020). A simple magnetic nanoparticles-based viral RNA extraction method for efficient detection of SARS-CoV-2. *BioRxiv*, 2020–2022.

Zheng, C., Zhu, K., De Freitas, S. C., Chang, J.-Y., Davies, J. E., Eames, P., Freitas, P. P., Kazakova, O., Kim, C., & Leung, C.-W. (2019). Magnetoresistive sensor development roadmap (non-recording applications). *IEEE Transactions on Magnetics*, *55*(4), 1–30.

Zhou, X., Sveiven, M., & Hall, D. A. (2019). A CMOS magnetoresistive sensor front-end with mismatch-tolerance and sub-ppm sensitivity for magnetic immunoassays. *IEEE Transactions on Biomedical Circuits and Systems*, *13*(6), 1254–1263.

Zhu, M., Lerum, M. Z., & Chen, W. (2012). How to prepare reproducible, homogeneous, and hydrolytically stable aminosilane-derived layers on silica. *Langmuir*, *28*(1), 416–423.

Zsurzsa, S., Péter, L., Kiss, L. F., & Bakonyi, I. (2017). Magnetic and magnetoresistance studies of nanometric electrodeposited Co films and Co/Cu layered structures: Influence of magnetic layer thickness. *Journal of Magnetism and Magnetic Materials*, *421*, 194–206.