SCHOLARLY PUBLICATIONS
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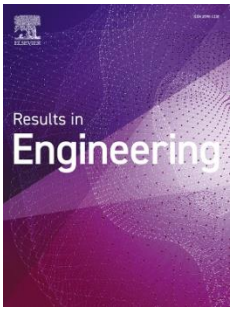
Journal Name: Results in Engineering **IF: 7.9**

Title: Experimental insights into injection timing effects upon VCR diesel engine fuelled with injected waste cooking oil ethyl ester-diesel blends and induced biogas operated in dual fuel mode

Author: Patra P.K.; Nayak S.K.; Mishra P.C.; Subbiah G.; Kaliappan N.; Priya K.

Details: Vol. 27, September 2025

Abstract: This study investigates the dual-fuel operation of a single-cylinder, four-stroke, 5.2 kW variable compression ratio (VCR) diesel engine fueled with a 20 % blend of waste cooking oil ethyl ester (WCOEE_20) and diesel as pilot fuel, and biogas (1.2 kg/h) as the inducted secondary fuel. The study aims to integrate renewable fuels into conventional diesel engines, promoting both efficiency and sustainability. Biogas was introduced through the intake manifold, while WCOEE_20 was directly injected into the combustion chamber. Experiments were performed at 1500 rpm and a compression ratio of 17.5:1, across varied injection timings (21°, 23°, 25°, and 27 °CA bTDC) to identify the optimal operating condition for enhanced combustion, performance, and emission behavior. Among all test cases, WCOEE_20+DFM25 °CA exhibited the best performance with a brake thermal efficiency (BTE) of 27.55 %—an improvement of 10.51 % over WCOEE_20+DFM23°, while 7.61 % lower than diesel operated in natural aspirated mode. Emission analysis showed reductions in CO (15.79 %), HC (16.0 %), NOx (17.41 %), and smoke opacity (28.49 %) relative to diesel fuel. Compared to WCOEE_20+DFM23°, smoke opacity decreased by 5.52 %, while NOx increased slightly by 9.67 %. Heat release rate (HRR) and cylinder pressure (CP) were found to be 3.58 % and 13.22 % higher than WCOEE_20+DFM23°, while 1.88 % lower and 10.02 % higher than normal diesel fuel in natural mode of aspiration. These findings demonstrate the potential of WCOEE_20+DFM25° as a cleaner and efficient alternative for diesel engine operation, supporting the United Nations Sustainable Development Goals (SDG) 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).



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SCHOLARLY PUBLICATIONS
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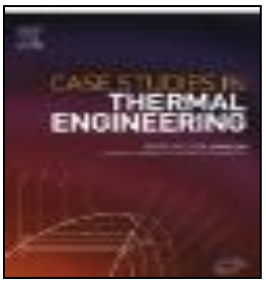
Journal Name: Case Studies in Thermal Engineering **IF: 6.4**

Title: Lanthanum oxide-enhanced botryococcus braunii biodiesel: A sustainable fuel for diesel engines

Author: Nayak, SK; Subbiah, G; Duraisamy, SK; Teja, NB; Yuvarajan, D

Details: Volume 73, September 2025

Abstract: The growing reliance on fossil fuels in diesel engines has led to serious environmental and energy sustainability concerns, necessitating the exploration of renewable biofuels. This study investigates the potential of Botryococcus braunii oil methyl ester (BBOME) as a biodiesel alternative and evaluates the influence of lanthanum oxide (La2O3) nanoparticles as a performanceenhancing additive. The novelty of this work lies in the integration of La2O3 nanoparticles into BBOME biodiesel to improve engine performance, combustion characteristics, and emission reduction, which remains an underexplored area in biofuel research. BBOME was synthesized via transesterification, and two concentrations of La2O3 nanoparticles (100 ppm and 200 ppm) were blended into a 30 % BBOME-diesel mix (BBOME_30). Performance, combustion, and emission characteristics were assessed using a single-cylinder, four-stroke, direct-injection diesel engine at 1500 rpm, a compression ratio of 17.5:1, and an injection timing of 21 degrees bTDC. The results demonstrated that the addition of 200 ppm La2O3 (BBOME_30+La2O3_200) enhanced brake thermal efficiency (BTE) by 6.5 %, while brake-specific fuel consumption (BSFC) was reduced, indicating improved fuel utilization. Emissions of carbon monoxide (CO), unburnt hydrocarbons (UBHC), and smoke opacity decreased by 12 %, 15 %, and 18 %, respectively. These findings establish that La2O3 nanoparticle-enhanced BBOME biodiesel offers a sustainable, highperformance alternative to conventional diesel, contributing to cleaner fuel technology. The study aligns with the United Nations Sustainable Development Goals (SDGs 7, 12, and 13) by promoting clean energy, responsible fuel consumption, and reduced environmental impact. The results indicate that La2O3-doped biodiesel could be a viable solution for improving diesel engine performance in transportation and industrial applications, thereby supporting global sustainability efforts.



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SCHOLARLY PUBLICATIONS
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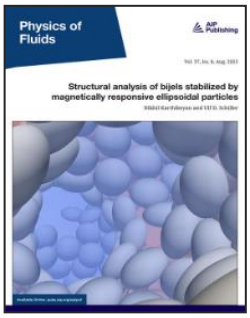
Journal Name: Physics of Fluids **IF: 4.3**

Title: Role of bubble size on hollow droplet collision onto thin liquid film

Author: Kundu P.; Shil D.C.; Rana B.K.

Details: Vol 37, Issue 8, August 2025

Abstract: The present work numerically explores the behavior of hollow droplet collision on a thin film surface by considering pertinent factors. Dimensionless quantities, such as diameter ratio (d / D) , Weber number (W e) , Ohnesorge number (O h) , and film thickness H o / D are employed to characterize the impingement mechanism of hollow droplets onto thin films. Characterization of radial spreading (f / D) , edge jet (h / D) , and central counter jet (L / D) is understood through a qualitative approach using numerical contours. Thus, temporal growth of f / D , h / D , and L / D are predicted for different values of W e , d / D , and H o / D . Similarly, predictions are extended for maximum spreading (f max / D) , maximum edge jet (h max / D) , and maximum central counter jet (L max / D) to enrich the characterization of insightful physics of hollow droplet collision on thin film surface. The reduction gradient of f max / D with d / D is anticipated to be steeper at a higher W e than a lower W e . It is noticed that the gaseous bubble does not burst at a higher magnitude of O h. Thus, a regime map on O h − d / D plane is anticipated to distinguish two separate regimes, such as bursting and no-bursting zones. Fluidic behavior of impingement mechanism is elucidated using velocity vectors. Finally, we have also proposed relevant correlations to predict the maximum spread f max * = f max / D , maximum edge jet h max * = h max / D , and maximum central jet L max * = L max / D in terms of different pertinent input parameters.



URL:https://pubs.aip.org/aip/pof/article-abstract/37/8/082114/3358140/Role-of-bubble-size-on-hollow-droplet-collision?redirectedFrom=fulltext

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Journal Name: Scientific Reports **IF: 3.9**

Title: Implementing a novel TOPSIS-sine cosine algorithm-based hybrid optimization in machining medium-hardened steel

Author: Kumar R.; Rafighi M.; Ä°ynen O.; Reddy M.P.K.; Zade S.; Ã–zdemir M.; Pandey A.; Singh R.

Details: July 2025

Abstract: Machining medium-hardened steel is particularly challenging because of its high strength and wear resistance, which generate excessive cutting temperatures. The elevated temperature contributes to rapid tool wear and negatively impacts surface quality. Optimizing tool selection, coating composition, geometry, and process variables is crucial for enhancing machinability. This study applied a novel hybrid TOPSIS-sine cosine algorithm to evaluate the performance of three chemical vapor deposited (CVD)-coated carbide cutting inserts in turning medium-hard AISI 4340 grade steel, considering the depth of cut (a), cutting speed (V), feed (f) and workpiece hardness as input variables. Experimentally obtained machining responses, namely resultant force (Fr), power consumption (Pc), surface roughness (Ra), and sound level (SL), were analyzed and compared to determine the optimum insert type. Insert type-3 (TiCN-Al2O3-TiN) demonstrated superior performance, achieving a 16.68% and 26.74% lower Ra than insert type-1 and type-2, respectively. Moreover, the optimal parameters for the most favorable insert (type-3) are determined as H = 30 HRC, V = 190 m/min, f = 0.1 mm/rev, and a = 0.2 mm. Workpiece hardness (H) emerged as the most influential factor affecting machining outcomes. This research recommended insert type-3 at optimized cutting conditions to improve machinability and sustainability in turning medium-hard AISI 4340 grade steel.

URL: https://www.nature.com/articles/s41598-025-07542-0

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Journal Name: Numerical Heat Transfer Part B-Fundamentals **IF: 3.8**

Title: Semi-analytical solution of influence of aspect ratio on heat transfer characteristic of flow of a Rivlin-Ericksen fluid of grade three through a rectangular channel

Author: Mohanty, RL; Das, M; Mishra, VK; Chaudhuri, S

Details: July 2025

Abstract: Effect of aspect ratio on thermal characteristics, including viscous dissipation, in pressure-driven flow of a third-grade fluid through a rectangular channel is considered. The walls of the channel are assumed to be maintained at uniform temperatures (the special case of the same upper and lower wall temperatures is also discussed). Earlier reported studies on heat transfer characteristics of third-grade fluids considered flow through large parallel plates. In actual case, however, flow occurs in channels and the parallel plate approximation results are only applicable near the central core of the channel, where, influence of the lateral walls is less. In view of this, in the present study, effect of the lateral walls is included in the governing equations and the results obtained are realistic from practical considerations. The effect of viscous dissipation is included in the energy conservation equation, and the influence of the aspect ratio is considered in the momentum and energy conservation equations. Momentum and energy conservation equations are formulated and reduced to their dimensionless forms by introducing suitable dimensionless variables and parameters. Entropy generation equation, including aspect ratio effect is deduced. The results are validated with the results of least square homotopy perturbation method. It is important to note that heat transfer is reversed (from the upper wall to the surrounding cooling medium) at a distance of nearly 50% from the lateral walls) with rise in Brinkman number. In the region from lateral walls up to this limit (50% from the walls) heat is transferred from the upper wall to the flowing fluid. Results of the study can serve to be useful for design and analysis of heat exchangers in which lubricating oils, polymers flow takes place

URL: https://www.tandfonline.com/doi/full/10.1080/10407790.2025.2530682#abstract

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Journal Name: Polymers for Advanced Technologies **IF: 3.4**

Title: Enhancement of Mechanical and Thermo-Physical Properties in CNTs/GO-Coated Carbon Fiber-Reinforced Epoxy Composites

Author: Singh M.; Dodla S.; Gautam R.K.; Jha P.

Details: Vol. 36, Issue 8, August 2025

Abstract: This study predominantly focuses on the application of carbon nanotubes (CNTs), graphene oxide (GO), and hybrid (CNTs/GO) onto carbon fibers through a spray coating process and examines the resulting impact of the coating on mechanical, tribological, and thermo-physical properties of polymer composite. The synergetic effect of two-dimensional GO and one-dimensional CNTs forms a three-dimensional network structure, resulting in significant enhancements in the mechanical and interfacial properties of fiber-reinforced polymer composites. The CNTs/GO hybrid coated carbon fiber reinforced epoxy (HCFRE) composite demonstrates superior performance in interlaminar shear strength (ILSS), flexural strength, tensile strength, and hardness, with an enhancement of 38.73%, 30.40%, 33.53%, and 32.64%, respectively, compared to carbon fiber reinforced epoxy (CFRE) composite. The fracture toughness, tensile, and flexural modulus of the HCFRE composite have improvements of 36.36%, 31.66%, and 57.68%, respectively, as compared to the CFRE composite. The HCFRE obtained the maximum thermal conductivity with a 44.44% increment compared to the CFRE composite. The tribological tests comprise four distinct sliding frequencies (6, 8, 10, and 12 Hz) and normal loads (30, 40, 50, and 60 N) with a consistent stroke length of 1.5 mm. Worn-out surfaces are studied by scanning electron microscope (SEM) images. For the HCFRE, the specific wear rate was decreased by 42.84% compared to the CFRE composite. As the normal load increases, the friction coefficient also increases, whereas it decreases with sliding frequencies.

URL: https://onlinelibrary.wiley.com/doi/10.1002/pat.70309