CONTRIBUTIONS TO FOOD AND AGRICULTURAL SCIENCE AND TECHNOLOGY

Professor Arun S. Mujumdar

Teaching • Research • Publications • Industrial and Global Impact

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A scholarly assessment of a career that helped shape modern drying science, food engineering and post-harvest technology

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Professor Arun S. Mujumdar

Contributions to Food and Agricultural Science and Technology

A report on teaching, research, publication, professional leadership and industry impact

Scope	Food engineering, agricultural processing, drying science and technology, research leadership and global knowledge transfer
Evidence base	Published curriculum vitae and institutional biographies; peer-reviewed tributes; publisher and conference records; bibliometric profiles accessed in July 2026
Length	Approximately 6,500 words, excluding references
Interpretive note	Rankings are database- and discipline-dependent and should be reported with the methodology and date attached.

Source note. The report distinguishes documented facts from evaluative interpretation. Bibliometric values evolve continuously; figures and ranks quoted here correspond to the cited source and access date rather than to a permanent universal ranking.

Contents

Executive Summary

Professor Arun S. Mujumdar has made a rare combination of foundational, institutional and translational contributions to food and agricultural science and technology. His central domain has been drying - one of the oldest, most energy-intensive and most widely used operations in food manufacture and post-harvest preservation - but the significance of his work is broader than any single unit operation. Across more than five decades, he helped move drying from a largely empirical craft toward a scientifically integrated field linking transport phenomena, equipment design, product quality, process control, energy analysis and industrial innovation.

His contribution can be understood through four mutually reinforcing roles. First, as a teacher and mentor, he educated generations of engineers in heat and mass transfer, transport phenomena, fluid mechanics and drying. His supervision of doctoral students, postdoctoral researchers and visiting scholars created a global lineage of academics and industrial specialists. Second, as a researcher, he advanced the analysis and design of conventional and emerging dryers, including impinging-jet, fluidized-bed, spray, heat-pump, superheated-steam, microwave, infrared and hybrid systems. He consistently emphasized that a successful dryer must be judged not merely by moisture removal, but by energy efficiency, product quality, safety, controllability and suitability for scale-up.

Third, as an author, editor and scientific organizer, he created much of the intellectual infrastructure through which drying knowledge has circulated. The Handbook of Industrial Drying became a standard reference spanning food, agricultural, chemical, pharmaceutical, mineral and environmental applications. His long editorship of Drying Technology and his founding role in the

International Drying Symposium series gave the field durable institutions, common terminology and a truly international community. Fourth, as an industrial consultant and advocate of academia-industry cooperation, he connected theoretical understanding with plant-level constraints. His consulting through Exergex Corporation and his extensive professional workshops encouraged companies to approach drying as an optimization problem rather than as a fixed utility operation.

The global reach of this work is exceptional. Mujumdar held or continues to hold appointments in Canada, Singapore, India, China, Thailand and elsewhere. He played an especially important role in expanding high-level drying research in Asia, where food and agricultural processing are economically and socially critical. His collaborations contributed to the development of research groups in China, Southeast Asia, South Asia, Australia, Europe and the Americas. These networks accelerated work on fruits, vegetables, grains, herbs, seafood, dairy ingredients and functional food powders, while also extending to non-food materials.

Bibliometrically, he is among the most influential living researchers associated with drying science and food engineering. Research.com's 2026 profile places him 48th worldwide and 4th in Canada in its category of Mechanical and Aerospace Engineering, using a discipline-specific D-index of 104, 874 publications and 40,694 citations in that database. This is not a food-science-only ranking, but it confirms unusually high engineering impact. His curriculum vitae also reports inclusion in the Stanford-Elsevier top-scientist database and describes his position in 2019 as within the top 0.05% of food scientists. Such results should be interpreted cautiously because classifications and citation windows differ, yet the convergent conclusion is strong: within drying science he is a field-defining scholar; within food engineering he belongs to the small group whose books, papers, students and institutions have influenced research worldwide.

The lasting importance of Professor Mujumdar's career lies in integration. He linked fundamentals to equipment, equipment to quality, quality to markets, and academic research to industrial need. His legacy is therefore not simply a large publication record. It is a global ecosystem of people, journals, conferences, books, research questions and industrial practices that continues to shape food preservation and agricultural processing.

1. Introduction: Why Drying Matters

Drying is indispensable to food and agricultural systems. Removing water slows microbial growth and chemical deterioration, reduces mass and volume for transport, improves storability, enables powder manufacture and creates textures that consumers value. It is used for grains, fruits, vegetables, herbs, spices, coffee, tea, dairy products, starches, seafood, meat ingredients, nutraceuticals and countless intermediate products. In many developing regions, effective drying is also a direct instrument for reducing post-harvest loss and stabilizing farmer income.

Yet drying is technically difficult. Water is bound within complex cellular or porous structures; internal diffusion and capillary transport interact with external heat and mass transfer; products shrink, crack, case-harden, discolor or lose aroma; enzymes and nutrients may degrade; and energy consumption can be substantial. A dryer that removes moisture quickly may produce poor quality. A gentle dryer may be too expensive. A laboratory result may fail at industrial scale because air distribution, residence-time distribution, fouling, cleaning, control or feed variability was overlooked.

Professor Mujumdar's work is important because it addressed this full systems problem. He treated drying as a multidisciplinary engineering science requiring thermodynamics, transport phenomena, materials behavior, equipment design, numerical modeling, quality measurement, economics and process integration. This perspective helped displace simple "time-temperature" thinking with a more rigorous framework: identify the controlling resistances, select or invent the appropriate contact method, model the coupled transfers, quantify energy and exergy use, and verify the resulting product quality.

The contribution also has an agricultural dimension. Drying sits at the interface between biological production and industrial transformation. Crops are heterogeneous, seasonal and perishable. Their moisture content, maturity, geometry and composition vary. Agricultural dryers must therefore accommodate uncertainty while remaining affordable and robust. Mujumdar repeatedly encouraged innovation that was context-specific rather than fashionable: the best system is not necessarily the most novel one, but the one that delivers quality, efficiency, reliability and economic value under real operating conditions.

This report evaluates his influence through teaching, research, publication, institution-building and industrial engagement. It also considers bibliometric evidence, while recognizing that no single ranking captures his interdisciplinary position. His work spans chemical engineering, mechanical engineering, food engineering, agricultural and biological sciences, energy systems and materials processing. Consequently, his true impact is better represented by a portfolio of indicators and by the visible development of the field than by one rank alone.

2. Career Overview and Institutional Reach

Mujumdar's career began with chemical engineering training in India, followed by M.Eng. and Ph.D. degrees at McGill University. Early industrial research experience at Carrier Corporation and work connected with the Pulp and Paper Research Institute of Canada exposed him to thermal systems, process equipment and applied research. These experiences were consequential: throughout his career he retained an industrial engineer's concern for scale, operability and usefulness.

He joined McGill's academic staff and progressed from assistant to full professor in chemical engineering. At McGill he taught core engineering subjects, supervised graduate research and took on substantial curricular and administrative responsibilities. He later served at the National University of Singapore from 2000 to 2013, where he was professor of mechanical engineering and engineering science and directed the Minerals, Metals and Materials Technology Centre. This period widened his disciplinary range and strengthened his connections across Asia.

From 2013 onward, his portfolio of adjunct, distinguished, honorary and emeritus appointments became a mechanism for global knowledge transfer. The documented appointments include McGill University, King Mongkut's University of Technology Thonburi, the Institute of Chemical Technology in India, Jiangnan University, Tianjin University of Science and Technology, Jiangsu University and the National Institute of Food Technology Entrepreneurship and Management.

Earlier and visiting affiliations included Western University, the University of Queensland and the Hong Kong University of Science and Technology.

These titles mattered because they were active rather than merely ceremonial. He lectured, initiated collaborations, mentored younger faculty, advised research strategy, co-authored papers, participated in conferences and linked institutions to his worldwide professional network. In China, where he had engaged with the drying community since the 1980s, this long-term presence contributed to a major expansion of food-drying research. Chinese accounts of his 2014 national awards specifically recognized his contribution to scientific cooperation and technological advancement.

His career also demonstrates an unusual balance of university and entrepreneurial activity. From 1989 to 2000 he was president and principal consultant of Exergex Corporation in Quebec, consulting for more than seventy companies according to an institutional biography. Rather than separating academic work from industry, he used consulting to identify high-value research questions and used research to improve diagnosis and design in practice. This reciprocal model anticipated today's emphasis on translational engineering.

The geographic span of his career is integral to the impact. Drying problems differ by climate, energy price, crop, infrastructure and market. By working across Canada, Europe and especially Asia, Mujumdar encountered a broad range of constraints and helped move scientific capacity toward regions where post-harvest preservation and food manufacturing were rapidly growing. The result is not only a body of papers, but a distributed international community with shared methods, meetings and reference works.

3. Contributions to Teaching and Mentorship

Teaching is one of the least visible but most consequential parts of Mujumdar's contribution. His formal teaching areas included transport phenomena, fluid mechanics, heat transfer, mass transfer and drying. These are foundational subjects: they enable engineers to move from descriptive observation to quantitative design. Students trained in these disciplines can calculate transfer coefficients, analyze boundary layers, estimate drying times, interpret dimensionless groups, and recognize when a process is controlled internally or externally.

His teaching philosophy, as reflected in his books, lectures and mentoring record, appears to have emphasized physical understanding before mathematical elaboration. Drying equations are useful only when linked to mechanisms. A falling-rate period, for example, should not be treated as a line on a curve but as evidence of changing internal transport and surface conditions. This habit of mechanistic interpretation became a hallmark of the research culture associated with him.

The scale of his mentorship was substantial. A McGill biography reported more than fifty-five Ph.D. graduates and approximately forty postdoctoral fellows by the mid-2010s; his longer curriculum vitae lists a large international group of doctoral researchers, postdoctoral scholars and visiting scientists. Many later became professors, research leaders, editors or senior industrial specialists. The impact is therefore multiplicative. Each trainee carried methods, standards and networks into another institution or country.

His mentorship was also unusually international. Researchers from China, India, Thailand, Singapore, Brazil, Spain, Japan and many other countries worked with or visited his groups. At a time when international mobility was more difficult and digital collaboration less mature, he actively created pathways for researchers from emerging systems to enter a global scientific network. Donations of books and journals to libraries in numerous countries, recorded in his curriculum vitae, complemented this human-capacity building.

A further contribution was professional development beyond degree programs. Mujumdar delivered short courses, workshops and keynote lectures aimed at practicing engineers and academics. Industrial drying often falls between disciplines: plant engineers may understand equipment but not product science, while food scientists may understand quality but not airflow or energy integration. His courses helped bridge these gaps. They also conveyed a disciplined approach to innovation: define the need, understand the physics, compare alternatives, consider scale-up and economics, and avoid novelty without value.

His mentoring extended to academic career development. He advised younger researchers on publication strategy, international collaboration, research-group building and service to the profession. This can be seen in the growth of the Transport Phenomena Research network, a collaborative community spanning many countries. The network helped researchers identify co-authors, compare methods and publish work with international visibility. It was an early form of distributed scientific capacity building.

The teaching impact is visible in contemporary food-engineering curricula. Topics that are now routine - drying kinetics, sorption isotherms, effective diffusivity, quality kinetics, computational fluid dynamics, hybrid energy inputs, exergy analysis and intelligent control - were normalized partly through the books, review papers, journal special issues and conference sessions he shaped. His educational influence therefore extends well beyond students who attended his classroom. It reaches anyone who has learned from the Handbook of Industrial Drying, from Drying Technology, or from the many researchers he trained.

Perhaps most importantly, his example taught that teaching, research and service need not compete. A well-taught fundamental course produces better researchers; an editorial role reveals unresolved questions; an industrial problem enriches teaching; a conference creates mentorship opportunities. Mujumdar organized these activities as a coherent professional mission centered on the generation and dissemination of useful knowledge.

4. Research Contributions to Food Science and Technology

Mujumdar’s food-related research is best viewed not as a sequence of isolated inventions but as a broad program to improve how drying systems are selected, analyzed and operated. He worked across fundamental transport, dryer configuration, product behavior, energy use and emerging technologies.

4.1 Transport phenomena and drying kinetics

A central contribution was the application of rigorous heat and mass transfer analysis to drying. Food materials are heterogeneous, deformable and often anisotropic. Their properties change as water is removed. Mujumdar promoted the use of drying curves, characteristic times, sorption relations, diffusion models and dimensionless analysis while also warning against treating fitted parameters as universal physical constants. Effective moisture diffusivity, for example, is often a lumped descriptor influenced by structure, temperature, shrinkage and model assumptions.

This methodological caution improved the quality of food-drying research. It encouraged investigators to connect parameters with mechanisms, report experimental conditions clearly, and validate models over relevant ranges. His review and editorial work also helped standardize terminology and comparison across studies.

4.2 Convective and impinging-flow systems

Hot-air drying remains the dominant industrial method because it is robust and scalable. Mujumdar's work on convective systems addressed airflow, transfer coefficients, bed behavior and equipment geometry. His highly cited review on numerical flow and heat transfer under impinging jets contributed to the understanding of localized high-transfer-rate systems. In food processing, impinging air can accelerate surface heat and mass transfer, reduce process time and support uniform treatment when nozzle design and product arrangement are optimized.

The significance lies not only in faster drying but in engineering control. Poor airflow distribution is a common cause of non-uniform moisture, overprocessing and energy waste. The use of computational fluid dynamics and experimentally validated flow analysis, promoted in his research community, gave designers tools to diagnose dead zones, bypassing and maldistribution before constructing full-scale equipment.

4.3 Spray drying and food powders

Spray drying is essential for milk powders, coffee, flavors, enzymes, encapsulated oils, probiotics and nutraceutical ingredients. Mujumdar's publications and edited works treated spray drying as a coupled atomization, droplet-transfer and particle-formation process. This perspective links inlet conditions and residence time to particle size, morphology, stickiness, solubility, retention of volatiles and wall deposition.

His broader influence on microencapsulation and powder technology helped food researchers view the dryer as a product-structuring device. A spray dryer does not merely remove solvent; it creates particles with specific surface, porosity, glass-transition behavior and rehydration characteristics. This conceptual shift is central to modern ingredient engineering.

4.4 Fluidized-bed, spouted-bed and particulate drying

Fluidized and spouted beds offer excellent mixing and transfer rates for grains, seeds, particulates and coated products. Mujumdar helped synthesize the underlying hydrodynamics, transfer behavior and scale-up considerations. For food and agricultural applications, these systems can improve uniformity and enable simultaneous drying, agglomeration or coating. His work emphasized the need to balance vigorous contact with attrition, segregation and product damage.

4.5 Superheated-steam drying

Superheated steam drying became one of the important advanced approaches discussed and developed within his research network. Because the drying medium contains little or no oxygen, it can reduce oxidative damage and offers possibilities for energy recovery. For certain foods it may improve color, aroma retention or texture, although condensation during start-up, sealing, heat recovery and product suitability require careful design.

Mujumdar's contribution was to evaluate the technology through transport and energy principles rather than promotional claims. This helped define where superheated steam offers genuine advantage and where conventional air remains preferable. Such balanced assessment is particularly valuable for industry.

4.6 Heat-pump and low-temperature drying

Heat-pump drying recovers latent and sensible heat and enables controlled low-temperature, low-humidity air. It is attractive for heat-sensitive fruits, vegetables, herbs and seafood. Mujumdar's publications and editorial leadership supported extensive development of this field, particularly in Asia. Research addressed coefficient of performance, dehumidification, closed-loop operation, quality retention and hybridization.

The global effect was to reposition low-temperature drying from a niche concept to a credible energy-efficient option. Many contemporary commercial and pilot systems for high-value foods reflect this research trajectory.

4.7 Microwave, radio-frequency, infrared and hybrid systems

Volumetric or radiative energy inputs can overcome slow internal moisture transport and long falling-rate periods. Mujumdar encouraged systematic exploration of microwave, radio-frequency and infrared assistance, often in combination with hot air, vacuum, freeze drying or fluidization. The research community examined non-uniform heating, runaway temperatures, dielectric-property changes and quality trade-offs.

His most important contribution here may be methodological: hybridization should solve a defined bottleneck. Adding an energy source is justified when it improves internal transport, shortens time, preserves quality or lowers total cost. This problem-led approach prevented "hybrid" from becoming a substitute for engineering analysis.

4.8 Freeze drying and quality preservation

Freeze drying produces premium quality but is capital- and energy-intensive. Mujumdar's reference works placed freeze drying within a comparative framework, helping engineers consider pre-freezing, primary and secondary drying, heat and mass transfer through the dried layer, collapse temperature, cycle optimization and alternatives. This systems view supports rational use of freeze drying for sensitive bioactives, cultures and high-value foods while encouraging intensified or combined processes where appropriate.

4.9 Quality, nutrition and product functionality

A defining feature of his food-engineering contribution was attention to the product. Drying alters color, flavor, texture, porosity, rehydration, nutrient retention and bioactive stability. His collaborations examined fruits, vegetables, herbs and other foods using kinetic, microstructural and physicochemical methods. This helped establish quality as a design variable, not an afterthought.

The resulting research influenced multi-objective optimization: process conditions should minimize energy and time while maximizing selected quality attributes. This framework is now standard in food-process engineering and increasingly supported by response-surface methods, artificial neural networks and machine learning.

4.10 Modeling, computation and intelligent drying

Mujumdar was an early advocate of mathematical modeling and later of computational and data-driven tools. Models ranged from lumped drying kinetics to distributed heat-and-mass-transfer equations and computational fluid dynamics. His recent co-authored reviews include artificial-intelligence-assisted drying control and 3D/4D food printing, showing continued engagement with new technologies.

The importance of intelligent drying is considerable. Biological raw materials vary from batch to batch. Sensors, soft-sensing models and adaptive control can infer moisture or quality and adjust temperature, humidity, velocity or power. By connecting classical transport with modern computation, his work helped create a pathway from empirical operation to smart, responsive drying systems.

4.11 Energy, exergy and sustainability

Drying consumes a large share of industrial process energy. Mujumdar consistently highlighted heat recovery, exhaust recirculation, staged operation, dehumidification, renewable energy and process integration. Exergy analysis, promoted in the literature associated with his field, reveals where useful work potential is destroyed and can guide improvements beyond simple energy balances.

For food and agriculture, this sustainability agenda is especially relevant. Energy-efficient drying can lower operating cost, reduce greenhouse-gas emissions and make preservation feasible in resource-constrained regions. His research legacy therefore aligns directly with current goals of decarbonization, circular processing and food-loss reduction.

5. Contributions to Agricultural and Post-harvest Processing

Agricultural drying differs from the drying of uniform industrial chemicals because the raw materials are living or recently living systems. Grain may continue to respire; fruits and vegetables contain cellular structures and enzymes; herbs contain volatile compounds; seeds may need to retain viability. Mujumdar's work helped bring engineering rigor to these biologically complex materials.

For grains and seeds, moisture removal is central to safe storage. The relevant challenges include large throughput, climatic variability, moisture gradients, stress cracking and energy cost. The broader drying literature shaped by Mujumdar provided tools for analyzing fixed beds, moving beds, fluidized systems and intermittent operation. It also encouraged attention to tempering, which permits internal moisture redistribution and can reduce quality damage.

For fruits and vegetables, the problem is often value preservation rather than simply storage stability. Color, shrinkage, rehydration, texture, vitamins and phytochemicals determine market acceptance. Research collaborations associated with Mujumdar examined pretreatments, osmotic dehydration, low-temperature systems, vacuum methods and hybrid energy inputs. The resulting knowledge supports production of dried snacks, ingredients and powders with improved sensory and nutritional properties.

Herbs, spices and medicinal plants are another important area. Their value depends on aroma and bioactive compounds that can be lost through excessive temperature or oxidation. Heat-pump, vacuum and infrared-assisted approaches are especially relevant. By integrating product-quality kinetics with transfer analysis, the field moved toward selecting conditions that protect volatile or thermolabile constituents.

Post-harvest loss reduction is a major societal impact. In regions with weak cold chains, drying can convert a rapidly perishable crop into a stable product. However, poorly designed dryers may be unaffordable, fuel-intensive or unable to meet quality standards. Mujumdar's repeated emphasis on appropriate technology, scale-up and economics helped frame research around adoption. Solar and renewable-assisted drying, for example, must address weather dependence, contamination, control and storage rather than merely demonstrate that drying occurs.

His international work in China, Thailand, India and other agricultural economies amplified this contribution. Collaborations with leading food-engineering groups generated a large literature on local crops and processing needs. This localized research has value beyond the specific commodity because it builds regional expertise in experimental design, modeling, equipment construction and publication.

The agricultural impact also includes by-products and biomass. Drying is needed for pomace, peels, spent materials and other residues before extraction, milling, combustion or incorporation into new products. The same transport and energy principles support circular bioeconomy applications. Although Mujumdar's career included minerals, sludge and other non-food materials, this breadth strengthened rather than diluted his agricultural contribution: cross-sector ideas such as fluidization, superheated steam, heat recovery and dewatering could be adapted to food and biomass systems.

Overall, his work positioned drying as a strategic post-harvest technology linking farm production to markets. It contributes to food security not only by extending shelf life, but by enabling diversification, value addition, transportation and the creation of stable ingredients.

6. Publications and the Architecture of a Global Field

Mujumdar's publication impact cannot be assessed only by counting papers. His distinctive contribution was to create several complementary channels of knowledge: original research articles, reviews, handbooks, edited volumes, journals, conference proceedings and freely distributed educational materials.

The Handbook of Industrial Drying is the best-known example. Across successive editions beginning in 1987, it assembled principles, equipment classes, modeling approaches and applications from a wide range of industries. For food engineers, the handbook offered access to expertise that would otherwise be scattered across chemical, mechanical and agricultural engineering literature. Its large scale and multidisciplinary authorship made it a design reference, a graduate text and a gateway into specialized topics.

The handbook also influenced how drying was taught and researched. By placing diverse dryers in one systematic framework, it enabled comparison. Researchers could see common mechanisms across foods, pharmaceuticals, paper, minerals and waste. This cross-fertilization accelerated innovation because solutions developed in one sector could be evaluated in another.

His role as editor-in-chief of Drying Technology from 1988 created an even more sustained platform. A scientific journal does more than publish papers: it defines standards, identifies emerging topics, develops reviewers and editors, and connects a community. Under his long leadership, the journal expanded internationally and became a central archive for drying science. Special issues and review articles helped consolidate new areas such as heat-pump drying, microwave assistance, superheated steam, modeling, energy analysis and smart control.

Editorial leadership also has educational effects. Authors from developing research systems learn how to frame questions, report methods and respond to critique. Reviewers develop judgment. Young scholars gain visibility. Mujumdar's global network enabled participation from countries that had previously been peripheral to the mainstream literature.

The International Drying Symposium series, which he founded in 1978, provided the face-to-face counterpart to the journal. The symposium became one of the field's enduring international meetings. It circulated among regions, facilitated collaboration, and exposed researchers to equipment, methods and problems beyond their home institutions. Conference proceedings preserved early-stage ideas that later matured into journal papers or industrial technologies.

He also edited a CRC Press book series and numerous thematic volumes. These works lowered the barrier to entering specialized areas. Review chapters could synthesize hundreds of studies, identify conflicting results and propose research needs. In a field with rapidly proliferating technologies, such synthesis is essential.

His own papers cover a broad range: drying kinetics, impinging jets, sorption isotherms, nanofluids, phase-change materials, renewable drying, artificial neural networks, food quality and more. Some highly cited papers fall outside food science, but they enhance his standing as a transport and thermal engineer. This interdisciplinarity gave his food-related work a larger toolkit and connected food engineering with mainstream energy and mechanical sciences.

A further publication contribution was advocacy for accessible knowledge. His biography notes e-books and technical reports made freely available through his website. Before open-access publishing became widespread, such dissemination was especially valuable to researchers and students in institutions with limited library budgets.

The combined result is an architecture of knowledge. The journal captures current work; the symposium creates community; the handbook organizes established principles; edited books explore emerging themes; and mentoring ensures that new researchers can use and extend the knowledge. Few scholars have influenced all of these layers simultaneously.

7. Influence on Academic Research

The academic influence of Mujumdar's work appears in the growth, geographic distribution and conceptual maturity of drying research. When the International Drying Symposium began, drying was often treated as an application-specific operation dispersed among industries. Today it is a recognizable interdisciplinary field with dedicated journals, conferences, research groups and graduate programs.

His influence on research questions was substantial. Rather than asking only how long a material takes to dry, researchers increasingly ask which mechanisms control the process, how quality evolves, how energy can be recovered, how a dryer scales, and how sensors or models can control it. These questions reflect the systems framework promoted in his books and editorials.

He also influenced research methods. The use of computational fluid dynamics to study dryer airflow, numerical models to couple heat and moisture transport, response-surface methods to optimize multiple objectives, and exergy analysis to assess thermodynamic performance all became common in the literature. More recently, artificial intelligence and digital twins have been added to this toolkit. Mujumdar's openness to emerging methods helped the field modernize without abandoning fundamentals.

His co-authorship network is another indicator. Collaborative publications connected senior and early-career researchers across institutions and countries. Such co-authorship does more than increase output; it transfers tacit knowledge about experimental reliability, manuscript construction and peer review. In China and Southeast Asia, these collaborations contributed to internationally visible schools of food-drying research.

A particularly important effect was the elevation of food engineering within broader engineering science. Drying of biological materials can sometimes be dismissed as commodity-specific work. Mujumdar demonstrated that it poses sophisticated questions in multiphase transport, porous media, phase change, rheology, microstructure and control. His publication record in both food journals and core engineering outlets helped bridge these communities.

The impact of his reviews is also significant. Review articles can become field maps, especially for students and interdisciplinary researchers. Papers on sorption models, artificial neural networks in drying, renewable drying technologies and heat-transfer topics have accumulated large citation counts because they organize evidence and provide common starting points. Their value lies in reducing duplication and clarifying where uncertainty remains.

Finally, his service roles helped shape academic norms. Long-term editorship requires decisions about rigor, novelty, duplication and ethical practice. Conference leadership requires balance among regions and topics. Mentorship requires judgment about promising ideas. Through these roles, Mujumdar influenced not only what was studied, but how the field evaluated and communicated research.

8. Industrial Impact and Technology Transfer

Industrial drying is often an under-optimized operation. Plants inherit equipment, operate conservatively to avoid wet product, and pay insufficient attention to exhaust losses, airflow distribution or product residence-time variation. Mujumdar's industrial contribution was to make drying performance diagnosable.

Through Exergex Corporation, professional workshops and direct collaboration, he worked with companies across sectors. An institutional profile reports consulting for more than seventy companies. The exact food-sector share is not publicly itemized, but the relevance to food and agriculture is clear because the same diagnostic principles apply: conduct mass and energy balances, measure air conditions, identify transfer bottlenecks, inspect flow distribution, quantify quality losses and compare retrofit options.

His reference books provided industry with a language for technology selection. Engineers could compare tray, tunnel, rotary, fluidized-bed, spray, drum, vacuum, freeze, heat-pump and superheated-steam systems against feed characteristics and product requirements. This reduces the risk of choosing equipment based on vendor familiarity alone.

The industrial influence of his academic network is larger than direct consultancy. Former students and collaborators have designed equipment, conducted trials, advised manufacturers and introduced new technologies. Research groups in Thailand and China, for example, have developed advanced food-drying processes and transferred them to local companies. Mujumdar's mentorship and international visibility helped these groups gain credibility and access to wider expertise.

Energy efficiency is one of the clearest industrial benefits. Dryers discharge hot, humid air that may contain recoverable heat. Heat pumps, recirculation, multi-stage operation, better insulation and control can reduce specific energy consumption. Even where a novel dryer is not justified, improved operation can produce significant savings. His emphasis on retrofitting and process intensification therefore has practical value for established plants.

Product quality is equally important. Faster or better-controlled drying can increase yield, reduce rejects, improve rehydration, preserve color and create premium products. For agricultural processors, such improvements can determine whether a dried product reaches export quality. The value created may exceed energy savings.

Mujumdar also communicated a realistic model of innovation. Laboratory novelty is not equivalent to commercialization. A technology must address capital cost, cleaning, sanitation, safety, maintenance, throughput, raw-material variability and operator skill. By repeatedly bringing these constraints into academic discussion, he improved the translational relevance of research.

His industrial impact is thus both direct and infrastructural. Directly, he consulted and taught practitioners. Indirectly, he supplied the books, methods, trained personnel and research networks through which thousands of engineers could improve processes. This distributed influence is difficult to monetize but is likely far larger than any single commercialized invention.

9. Global Scientific Leadership and Recognition

Mujumdar's honors reflect both scholarly achievement and international service. He is a Fellow of the American Society of Mechanical Engineers, the Canadian Institute of Chemistry or its chemical-engineering society tradition, the Institution of Engineers Singapore and the Indian Institute of Chemical Engineers. He received honorary doctorates from Lodz University of Technology and the University of Lyon.

China conferred particularly significant recognition. In 2014 he received the national International Science and Technology Cooperation Award and the Friendship Award, honors recognizing sustained contributions by foreign experts. These awards are consistent with his decades-long collaboration with Chinese universities and industry in food and agricultural drying.

The field itself created the Arun S. Mujumdar Medal for excellence in drying research, professional service and mentorship. Naming a continuing international award after a living scholar is evidence of community-level recognition. Lifetime-achievement awards at major drying conferences and tributes marking his editorial anniversaries reinforce that standing.

His leadership is also visible in institutions he founded or shaped. The International Drying Symposium series has continued since 1978. Drying Technology has remained a central specialist journal. More recent initiatives, including international research associations and book series, extend that ecosystem.

Global leadership, however, is not merely a collection of titles. It is the capacity to convene. Mujumdar connected chemical engineers, mechanical engineers, food scientists, agricultural engineers, materials researchers and industrial practitioners. He also connected regions: North America and Europe with rapidly developing Asian research systems. This convening role accelerated the internationalization of food engineering.

His reputation as the "Drying Guru," while informal, captures a substantive reality: researchers across countries treated him as a source of technical judgment, editorial guidance and career mentorship. Such reputational capital can be used narrowly, but he appears to have used it to expand participation, support younger scholars and create durable platforms.

10. Bibliometric Position and Research Ranking

Any statement of rank requires careful qualification. Bibliometric databases differ in coverage, author disambiguation, citation counting, field classification and treatment of co-authorship. Mujumdar's work is especially difficult to classify because it spans food science, agricultural and biological sciences, chemical engineering, mechanical engineering, energy and materials.

The most current explicit rank located for this report is Research.com's 2026 Mechanical and Aerospace Engineering profile. It reports a discipline-specific D-index of 104, 874 publications and 40,694 citations, with a world rank of 48 and a Canadian rank of 4. The page also notes substantial output in agricultural and biological sciences and identifies food drying, modeling, microencapsulation and related food topics among his main research areas.

This rank should not be restated as "48th in food science," because that is not the category used. It does, however, show that a researcher known primarily for drying and food engineering has citation influence comparable with leading mechanical and thermal engineers worldwide. Within Canada, fourth place in that category is a strong indicator of national standing.

A second line of evidence comes from the Stanford-Elsevier science-wide citation database. Mujumdar's 2021 curriculum vitae reports that the 2019 version placed him in the top 0.05% of food scientists. The Stanford database uses a composite citation indicator and provides both career-long and single-year views across standardized subfields. Because the exact annual row and rank should be verified directly from the relevant data release before use in a formal nomination, the safest conclusion is that he has repeatedly fallen within the extreme upper tail of citation impact.

Google Scholar generally reports larger citation counts than curated databases because of broader coverage. A peer-reviewed 2020 tribute recorded more than 550 international journal publications, nearly 50,000 citations and an h-index of 90 at that time. Current values are likely higher, but they change daily and should be captured by date if quoted.

How, then, should his global and Canadian position in food science and technology be described? The evidence supports the following formulation. Globally, Professor Mujumdar is among the most highly cited and institutionally influential researchers in food engineering and is arguably the most prominent scholar specifically associated with drying science. In Canada, he is among the country's leading engineering researchers by citation-based rankings and one of its most internationally influential contributors to food-process engineering. An exact food-science rank cannot be asserted without choosing a specific database, year and subject taxonomy.

The bibliometric record should also be interpreted in qualitative context. His papers are only one part of the impact. Handbooks, editorship, conferences and mentorship may receive fewer direct citations than journal articles but exert profound field-level influence. Conversely, some of his most highly cited papers concern nanofluids or thermal management rather than food. A fair assessment therefore combines metrics with documented contributions to the infrastructure and practice of food and agricultural engineering.

11. Overall Legacy

Professor Arun S. Mujumdar's legacy can be summarized as the transformation of drying from a fragmented industrial operation into a connected global science and engineering discipline. He did not accomplish this alone, and he consistently credited students and collaborators, but his coordinating role was exceptional.

His intellectual legacy is a systems view of drying. Moisture removal, heat transfer, structure, quality, energy and economics must be considered together. This principle remains relevant as the field moves toward machine learning, digital twins and decarbonization. Advanced computation cannot replace correct physical formulation; renewable energy cannot rescue an inefficient dryer; and rapid processing is not progress if quality is destroyed.

His educational legacy is a worldwide academic family. The students, postdoctoral fellows and younger collaborators he mentored now lead research groups and train others. This network ensures continuity while allowing the field to evolve.

His institutional legacy comprises the journal Drying Technology, the International Drying Symposium series, the Handbook of Industrial Drying and associated books and professional networks. These platforms outlive individual projects and make cumulative science possible.

His translational legacy is the insistence that research must remain connected to industrial need. Food and agricultural processors operate under cost, sanitation, quality and reliability constraints. The best research creates options that can survive these constraints.

Finally, his global legacy is one of scientific inclusion. By investing time in institutions across Asia and other regions, distributing knowledge and supporting international collaboration, he helped broaden who could contribute to high-level food engineering. The resulting field is more diverse, more productive and more relevant to global food systems.

Conclusion

Professor Arun S. Mujumdar has made seminal contributions to food and agricultural science and technology through an unusually integrated career in teaching, research, publishing, professional leadership and industry engagement. His technical work advanced the understanding and design of conventional and emerging drying processes. His emphasis on product quality, energy efficiency, modeling and scale-up helped modernize food-process engineering. His work on agricultural materials supported post-harvest preservation, value addition and food-loss reduction.

The broader impact is institutional. The Handbook of Industrial Drying, Drying Technology and the International Drying Symposium created durable mechanisms for the accumulation and dissemination of knowledge. His mentorship produced a global network of researchers whose influence extends far beyond his own publications. His consulting and professional education brought scientific analysis into industrial practice.

Available bibliometric evidence places him within the highest tier of internationally influential engineering researchers. Research.com's 2026 category ranking of 48th worldwide and 4th in Canada in Mechanical and Aerospace Engineering is the clearest current numerical indicator, while Stanford-Elsevier and Google Scholar evidence confirms exceptional citation impact in food-related fields. Exact rankings vary, but the substantive conclusion does not: Professor Mujumdar is a field-defining scholar in drying science and one of Canada's most globally influential contributors to food and agricultural process engineering.

His enduring contribution is a model of scholarship in which fundamental science, useful technology, education and international service reinforce one another. That model remains highly relevant as the world seeks lower-energy processing, reduced food loss, better nutrition and more sustainable agricultural value chains.

Selected bibliometric indicators

Source / year	Category	Metric	World position	Canada position
Research.com, 2026	Mechanical & Aerospace Engineering	D-index 104; 874 publications; 40,694 citations	48	4
Stanford-Elsevier, 2019 as reported in CV	Food Science subfield	Reported in top 0.05%	Not stated here	Not stated here
Google Scholar, Feb. 2020 tribute	Cross-disciplinary profile	~50,000 citations; h-index 90	No formal rank	No formal rank

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