



# Importance of drying in support of human welfare

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GUEST EDITORIAL

## Importance of drying in support of human welfare

Feeding the increasing global population is a grand challenge. There is 80% probability that world population will increase from current 7.2 billion people to between 9.6 billion and 12.3 billion in 2100.<sup>[1]</sup> In addition, with rising income and urbanization, the food-consumption patterns around the world are shifting to resource-intensive, animal-based foods.<sup>[2]</sup> It is estimated that by 2050, more than twice as many people will live in cities as did so in 2000 and 40% more land is needed by 2030 to feed the increasingly affluent urban population.<sup>[3]</sup>

Food security is also threatened by climate change, water crisis, soil pollution and degradation, agricultural land occupation by industrialization and urbanization, among other factors. It is predicted that the increasing temperature and declining precipitation over tropical, subtropical and semi-arid regions are likely to reduce yields for corn, wheat, rice and other primary crops in the near future; climate change, particularly, the extreme weather, would clearly have a substantial impact on global food security.<sup>[4]</sup>

To ensure food security, major changes are needed to transform current practices of food production, storage, distribution and consumption.<sup>[5]</sup> As an essential processing operation for safe storage of agricultural products and food, drying plays a critically important role in enhancing global food security. By removing the moisture to a safe level, drying can prevent the growth and reproduction of microbial proliferation, mitigate moisture-mediated deteriorative biochemical reactions, reduce the costs of packaging, transportation, storage and processing, so as to reduce postharvest losses, extend shelf life and increase added value.<sup>[6]</sup> It is noteworthy that by carrying out drying sustainably under optimal operating conditions in well-designed dryers with smaller energy and physical footprints, it is feasible to enhance food quality cost-effectively. This requires inter- and multi-disciplinary research and development effort around the globe. Innovation and cost reduction can be obtained by international cooperation and networking. Reliable mathematical modeling allows one to design and scape up new dryer types for enhanced efficiency and lower life cycle costs.

Inadequate and improper drying leads to serious losses. China's annual grain losses caused by insufficient drying and microbial spoilage are as high as 21 million tons, accounting for 4.2% of the total grain output of the country. This is more than 4 times the amount of new

grain each year; this seriously affects food security in China.<sup>[7]</sup> Similar results can be noted in other parts of the globe. Furthermore, inadequate drying can trigger serious food safety issues, which can threaten people's health and national security. According to the Food and Agricultural Organization (FAO) statistics, about 25% of the world's agricultural products are contaminated by mycotoxins due to inadequate or improper storage conditions and 2% of agricultural products lose their nutritional and economic value due to pollution; this causes hundreds of billions of dollars in economic losses.<sup>[8]</sup>

The most frequent problem that occurs in food products are due to development of aflatoxins, which possess high toxicity and carcinogenicity as well as resistance to degradation under normal food processing conditions. Aflatoxin is a serious threat to human and animal health; aflatoxin B<sub>1</sub> is classified as Group 1 carcinogens by the International Agency for Research on Cancer (IARC).<sup>[9]</sup> It is estimated that up to 28% of liver cancers worldwide are due to aflatoxin pollution,<sup>[10]</sup> which is most likely to occur on insufficiently dried foods such as peanut, maize, spices and herbs.<sup>[11]</sup>

Drying plays an important role in sustainable global development. As one of the most energy-intensive industrial operations, drying consumes 7-15% of the total industrial energy consumption in most countries.<sup>[12]</sup> Considering the huge total energy consumption of drying and the low energy utilization efficiency of the current dryer of only 25-50%, efficient drying can and should play an important role in achieving low carbon and sustainable development as well as curbing climate change. In fact, even small improvements in energy efficiency of drying can lead to huge energy savings through process optimization, employing multi-stage drying, intermittent drying as well as using energy saving technologies via the use of renewable energy sources on a larger scale.

As one of the oldest methods for preserving food and the most frequently employed industrial operation, drying has been considered as a mature and well developed technology. For a long time, the investment in drying research has been far lower than it should be, considering the contribution of drying research to national food security, human health and global sustainable development. Although this Editorial is confined to drying of foods, drying is a commonly encountered unit operation in most industrial sectors ranging from pulp and paper,

pharmaceuticals, ceramics to wood processing. A large number of very talented and dedicated young scientists in drying research have often encountered difficulties in securing research grants as granting agencies and referees are often not aware of the significance of this operation to national economy and well-being. R& D investment in this area can give rich dividends, which often are nevertheless difficult to quantify.

So, we hereby call for increased and sustained support for drying research and development, especially for the young scholars, in the interest of world food security, human health and global sustainability. Government funds are typically limited and need to be allocated according to scientific significance or need not be prejudiced by what is fashionable or promoted as hot areas. Industry and academia need to explore strategies for nurturing drying research that results in economic benefit to the society. The drying research scientific community must realize that just publishing their research in an academic journal is not adequate. They should open their arms to the wider community of policy-makers, industrialists and the public, so as to enhance their understanding of the important role drying plays for ensuring food security, human health and sustainable development. It is worth noting that drying R&D in other industrial sectors also has a very important role in enhancing the standard and quality of life.

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