From Waste to Wealth

Fish smoking, which is the most widely used method for preserving fish in West Africa, can be ramped up by adopting improved techniques and innovative technology

Smoked fish is a delicacy in West Africa, making fish smoking the most important and widely used method for preserving fish. Fishing communities have poor access to fresh fish. What also drives the preference for this method is the scarcity of electricity, resulting in a lack of cold-chain facilities. Fish smoking is also a means of product differentiation.

Fish smoking is a gendered activity here, dominated by women operating popular traditional or local fish smoking kilns such as smoking platforms or altars, barrels/drum kilns, mud kilns, Chorkor kilns, Altona kilns, Banda kilns and firewood as the main fuel or energy source.

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Traditional fish smoking kilns, characterized by fuel inefficiencies, consume more fuelwood than necessary and contribute to forest depletion. (This also compromises the forest's role as a carbon sink to combat climate change.) Burning of biomass, especially fuelwood, in the traditional kilns produces copious volumes of smoke that contain significant quantities of health-damaging pollutants, including several carcinogenic compounds identified as polycyclic aromatic hydrocarbons (PAHs), a food safety hazard.

Several studies have reported impermissible Polycyclic Aromatic Hydrocarbons (PAHs) levels in smoked fish in the informal or domestic markets, and high contents are major causes of product rejections at points of entry into the European markets. These unacceptably high PAHs levels can trigger risks of cancer in consumers. PAHs cause post-harvest loss because of problems in both food safety or quality and trade volumes. They are particularly difficult to remove because they are lipid-loving, accumulating in fish flesh during smoking.

Fish smoking in kilns also wastes time, requiring constant attention to turn the fish, else the smoked product may be charred and laden with deposits of tar particles. Fish smokers are exposed to several health hazards from the direct heat, with smoke entering their eyes and lungs, also suffering burns particularly on their fingers. Studies have shown a correlation of chronic obstructive pulmonary disease (COPD), poor eyesight, headaches, burning eyes and dizziness with fish smoking, not only for the women but also for their children, who may be present while their mothers work at smoking the fish.

Despite these drawbacks, traditional and local kilns are still widely used among fish smokers in the small-scale fisheries sub-sector. This is despite attempts to introduce improved fish-smoking technology designs that are more fuel-efficient, reduce laborious rotation time, shorten batch process time, improve batch capacity, cause less smoke, and produce fish with low PAHs.

Research institutes, tertiary institutions, development agencies and cross-cutting collaborations and partnerships have produced several designs of charcoal smoking kilns for fish smokers. Some of these are built on existing technologies such as the drum kiln, the Chorkor kiln and the Banda kiln, improving them further to produce

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modified or improved technology such as the Altona kiln, improved box and mud kilns, the Kainji gas kiln, modified drum kiln technology, the Ahotor kiln and, recently, the FAO-Thiaroye fish-smoking technology (or FTT-Thiaroye).

Major constraints

The major constraints to adopt improved fish-smoking technologies include the high cost of kilns available, low relative advantages, inadequate information dissemination and knowledge sharing by extension workers. Their low carrying capacity becomes a problem during the peak season. Acceptability of charcoal and gas smoking kilns particularly face more challenges than kilns which use firewood because the smoked products are reported to be devoid of the desirable smoky flavour and odour consumers cherish, which points to the exclusion of local end-users' knowledge in technology development.

Apparently, fish smokers have not been engaged in the design, construction or technology transfer of most fish-smoking equipment. This indicates the lack of a bottom-up or participatory approach in the research agenda. More so, the research approach tends to be monolithic and conducted in 'silos' without cross-sectoral or transdisciplinary interactions among stakeholders.

Biomass is considered the fuel of the poor, especially in communities close to forests, where it is easily available and 'free' to collect. The quantity of wood consumed is determined by the amount of fish requiring smoking and the type of kiln used. Wood quality is important in fish smoking and there are several species of trees used as fuelwood. The major factors determining wood quality choices or selection of fuelwood include the capacity of the species to provide heat energy, followed by the ability to colour the fish attractively, as also continuity of supply without any shortages.

A classic example of a popular fuelwood is the mangrove tree. In many West African coastal communities, mangrove wood is highly prized for smoking fish, especially the red mangrove *(Rhizophora racemosa)*. The wood of this species, burnt either wet or dry, is favoured because it has a higher thermal capacity and burns slowly. The rich tannins from burning the stilt roots infuse the fish with the much-coveted shiny, reddish-brown colour. It is also believed that the tannins increase the shelf life of smoked fish.

Nonetheless, harvesting of mangroves for smoking fish debilitates the major source of income for the fishermen who supply fish. Mangrove trees are an important habitat for the breeding of fish resources. Their loss decreases fish stocks. This trickles down the value chain and affects the livelihoods of fish smokers because the sustainability of firewood is sabotaged. This has a negative impact on food security among fishing communities. The other trees commonly used as fuelwood include mango, kola nut, plum, coconut and guava.

As in the case of developing improved fish-smoking kilns, there have been concerted efforts to replace, substitute or suggest fuelwood with alternative fuels. However, fuel switching has been hampered by a lack of access to alternative fuel sources, unaffordable costs when available and the low use of improved fish-smoking stoves. Charcoal is encouraged as a cleaner biomass to fuelwood in fish smoking but it is costlier. Also, local fish smokers exhibit a string of biases against fuelwood. As a result, charcoal continues to play second fiddle to fuelwood.

Charcoal, however, is a wood product and, like fuelwood, contributes to forest depletion. The charcoal supply chain sector is informal, poorly regulated and has its own share of challenges of quality and unsustainability. There are no clear indications or means of verifying locations where trees are felled or whether they are harvested from sustainable wood lots. Wood species may not be known and the major production technique—use of earthen kilns—is inefficient with small-scale producers using more wood to produce little charcoal with higher emissions, compared to emerging carbonization techniques. There may be a lot of intermediaries in the supply chain,

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Mud oven with layers of fish trays in Lagos State, Nigeria. Traditional fish-smoking kilns, characterized by fuel inefficiencies, consume more fuelwood than necessary and contribute to forest depletion

with skewed profits going to some over others. This could lead to sharp practices such as packing or bagging lower weights of charcoal or deliberate mixing or adding impurities to make up the standard weights before it gets to the end user.

Potential alternatives

Alternative fuels that could reduce wood consumption are rarely used as fuel; instead, they are used to improve the properties of smoked fish for better sales or to improve fuelwood combustion. Agro-wastes are potential alternative fuels that are easily available but have been poorly investigated in the production of carbonized biomass briquettes. Bamboo, sawdust/wood shavings, rice husks, groundnut shells, melon seed shells, and invasive aquatic plants such as water hyacinth, to mention a few, are good candidates. The abundance and availability of such biomas make it ideal.

Paras 7.2 and 7.5 of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the SSF Guidelines) state the following: support improvements to facilitate women's participation in the post-harvest subsector; avoid post-harvest losses and waste; and seek ways to create value addition, building also on existing traditional and local cost-efficient technologies, local innovations and culturally appropriate technology transfers. The SSF Guidelines also emphasized promotion of environmentally sustainable practices within an ecosystem approach, deterring waste of inputs like fuelwood in small-scale fish handling and processing. Converting wastes into wealth helps solve the environmental problems and challenges water hyacinth poses to several fishing communities and livelihoods highly dependent on fisheries in West Africa.

Advantages

Finally, biomass briquettes may offer competitive economic, social and nutritional advantages over charcoal and fuelwood in fish smoking. Though very little empirical research has been done in these areas, the prospects are quite real, just waiting to be tapped by the informal sector.

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