CONSTRUCTION AND OPERATION OF AN INEXPENSIVE FISH SMOKEHOUSE

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ABSTRACT

An inexpensive fish smokehouse capable of producing 150 pounds (approximately 240 mullet) each cook has been constructed and operated, utilizing laboratory personnel. This smokehouse, consisting of a steel drum firebox and a 4-foot x 4-foot x 4-foot plywood smoker was built with 16 hours of unskilled labor using common hand tools. The materials purchased at retail on the local market cost $45. The design permits fairly accurate control of smoke temperature.

INTRODUCTION

Traditionally, the mullet industry of the Gulf and South Atlantic states has depended on the sale of fresh fish (Brawner and A'brams 1956). In recent years, however, owing to consumer resistance to the sale of whole fresh fish, the mullet market has undergone a loss of volume in competition with other fishery products merchandised in a more convenient form.

Smoked mullet is considered a delicacy, but is not widely available. Promotion of this product could lead to utilization of a large volume.

Various kinds of apparatus are used to produce a smoked product from mullet. The product often varies in salt content, moisture, texture, and degree of smoke flavor. A project was undertaken at the Pascagoula Technological Laboratory, therefore, to build a fish smokehouse that could (1) be easily constructed by unskilled labor at minimum cost and (2) produce a uniform product having good taste acceptance.

CONSTRUCTION

The smokehouse consists of two major parts: (1) a firebox and (2) a 4-foot x 4-foot x 4-foot plywood smoker. The separate units are necessary to prevent fire hazards and permit control of smoke temperatures.

Table 1 - Materials and Costs

Materials	Costs
	Dollars
3 sheets of $\frac{1}{4}$" AC exterior plywood	17.40
38 pcs. of 2" x 2" x 4' #2 lumber	2.28
1 lb. of 3 penny galv. nails	0.28
1 lb. of 8 penny finishing nails	0.25
2 pr. brass butt hinges	0.49
2 hooks and eyes	0.12
2 qts. of wood sealer	4.00
1 90° -6" galv. stovepipe ell	0.94
8' of 6" galv. stovepipe	4.00
4 cement blocks	1.28
1 55-gallon oil drum	6.00
16 sq. ft. of $\frac{1}{2}$ in. mesh hardware cloth	2.40
20 doz. eye hooks, small plated	4.56
1 door handle	0.55
20 doz. hooks (made from stainless steel wire)	0.30
Total	44.85

The firebox is constructed from a 55-gallon drum having a removable clamp-on lid (see fig. 1). A 8-inch x 10-inch door is cut near the bottom rim of the drum, using a cold chisel and hand hacksaw. The cutout piece is refitted as a door by attaching it with a pair of brass butt hinges.

On the opposite side of the drum and near the top, a hole 6 inches in diameter is made to fit in a piece of stovepipe. Furnace cement should be used to seal the cracks between the pipe and drum. Eight feet of six-inch galvanized stovepipe is attached at the top rear of the firebox and at the bottom center of the smoker. The simplest procedure is to set up

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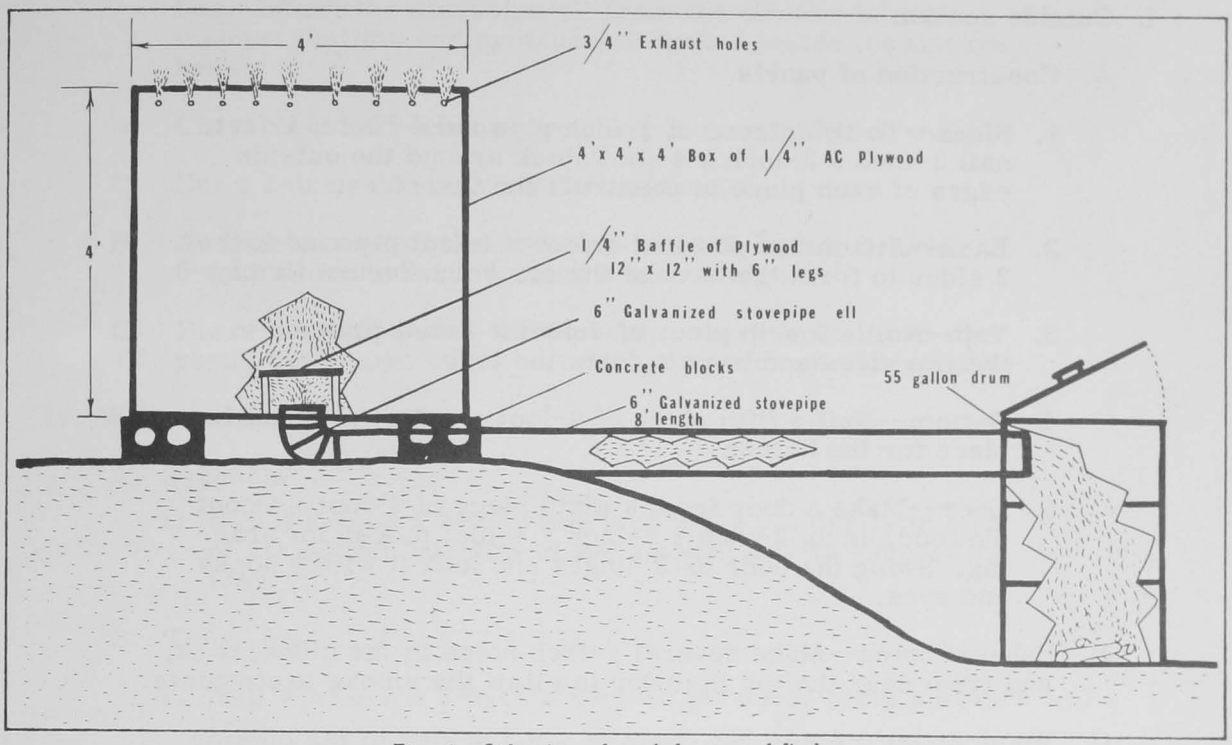

Fig. 1 - Side view of smokehouse and firebox.

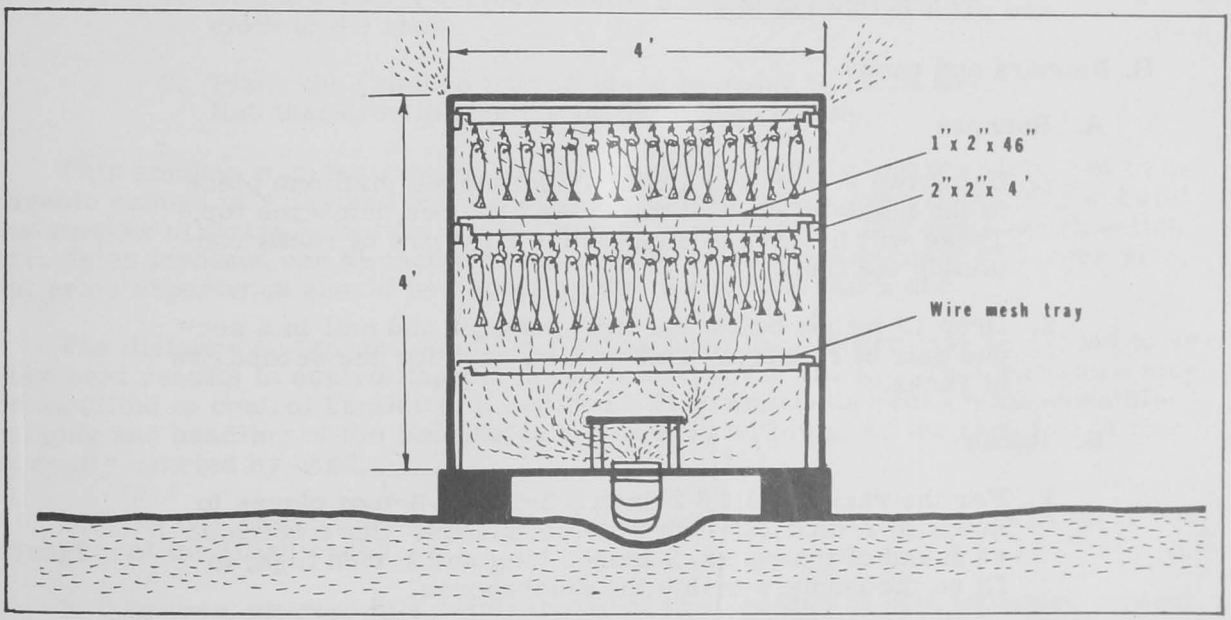

Fig. 2 - Open front view of smokehouse.

the smokehouse on a bank or steep slope with the firebox on the lower grade. Otherwise the smoker must be raised on blocks, or a blower used to gain circulation of the smoke.

The construction of the smokehouse involves the building of four sections: (I) outside section, (II) runners and racks, (III) baffle, and (IV) wire-mesh tray. Materials and costs are shown in table 1. Illustrations and dimensions are shown in figures 1 and 2. Directions for construction are as follows:

I. Outside section

A. Construction of panels

1. Sides--To two pieces of $\frac{1}{4}$-inch plywood 4-feet x 4-feet, nail 2-inch x 2-inch x 4-foot stock around the outside edges of each piece to construct the two sides.

2. Back--Attach one piece of 4-foot x 4-foot plywood to the 2 sides to form the back of the smoker. Secure firmly.

3. Top--Nail a fourth piece of 4-foot x 4-foot plywood to the two sides and back to form the top.

4. Bottom--Nail a fifth piece of 4-foot x 4-foot plywood in place for the bottom.

5. Door--Make a door from a sixth piece of 4-foot x 4-foot plywood, using 2-inch x 2-inch x 4-foot pieces for bracing. Swing the door on 3 hinges and lock it with 2 hooks and eyes.

B. Exhaust holes--Make several $\frac{3}{4}$-inch holes in the sides, back, and front near the top in order to allow the smoke to circulate.

C. Wood sealer--Apply two coats of wood sealer to the outside only to prevent warping of the plywood. Do not use sealers and paint inside the box.

II. Runners and racks

A. Runners

1. Using two 2-inch x 2-inch x 4-foot pieces, nail one piece to the inside of each of the sides 4 inches below the top. These will be used to support the first row of racks containing the fish.

2. Drop 12 inches below the first runners and nail in a second pair of runners. This will be used for the second row of racks.

B. Racks

1. For the racks, split 8 2-inch x 2-inch x 4-foot pieces to make 16 1-inch x 2-inch x 4-foot pieces. Cut a notch on each end of the racks, 2 inches long and 1-inch high, to fit on the runners inside the smokehouse.

2. Screw small eye hooks into the lower edge of the racks 3 inches apart, using 15 hooks per rack. Make 2-inch "S" hooks from stainless steel wire for attaching the fish.

3. Place the racks on the runners 5 inches apart.

III. The baffle

A. Cut a hole 6 inches in diameter in the bottom of the smoke

box. Insert the stovepipe ell from the firebox in such a manner that the end protrudes 2 inches inside the smokehouse.

B. Cut a piece of $\frac{1}{4}$-inch plywood 12-inches x 12 inches.

C. Cut 4 2-inch x 2-inch x 6-inch pieces.

D. At each corner of the plywood, nail a 2-inch x 2-inch x 6-inch piece to form a stand 6 inches high.

E. Place the baffle over the stovepipe entry in order to disperse the smoke over the entire smokehouse. (See fig. 2.)

IV. Wire-mesh tray

A. Supports

1. Nail a 2-inch x 2-inch x 8-inch piece vertically in each of the bottom corners of the smokehouse to support the tray.

B. Tray

1. Nail 4 2-inch x 2-inch x 46-inch pieces to form a square tray.

2. Nail a 4-foot x 4-foot piece of $\frac{1}{2}$-inch mesh hardware cloth to the tray.

3. Place the finished tray in place in order to catch any fish that drop during the smoking operations.

This smoker was designed to smoke fish inexpensively and properly, yet to be durable enough to withstand months of use. Sixteen hours were necessary to build the smoker utilizing Scientific Aides from the laboratory. The same construction principles involved can be modified to construct a fish smokehouse of larger size, but prior experience should be gained by the use of this small one.

The distance of separation of the firebox from the smoker may be varied to secure best results in controlling the temperature of the smoke. This structure may be modified to control humidity, if desired. The removable racks make possible hanging and handling of the fish inside a screened building, as the rack full of fish is easily carried by hand.

Hinging one entire side as a door to the smokehouse permits easy hanging and changing of the filled racks.

In this area, storage in a refrigerator of smoked fish of high moisture content quite often results in surface mold on the fish after three to four weeks. The design of this smoker with detachable racks lessens handling and thus lowers mold-spore contamination.

The baffle placed over the end of the stovepipe helps to disperse the smoke more evenly. Smoke from the incoming pipe would otherwise move through a small area of fish and not touch the remaining portion. The $\frac{3}{4}$-inch exhaust holes around the upper edges of the smoker serve the same purpose in that they create a flow of smoke from all sides of the box and cause a draft from the firebox.

Fish are not only smoked as a means of preserving the meat, but also because of the pleasant taste contributed by the smoke. Therefore, smoked fish is subject to spoilage even under the most sanitary handling conditions. Molds and yeast are responsible for the spoilage in smoked fish and refrigeration must be used to extend the storage life.

THE SMOKING OPERATION

A total of 240 mullet of average size (weighing a total of 150 pounds) are scaled and cut into butterfly fillets with heads left intact. Brining is done in 10-percent salt (37.7 salometer reading) at room temperature for one hour. The mullet are drained long enough to be dry to the touch which produces a glossy pellicle that acts as a protective coating. After being drained, the mullet are hooked through the eye by the stainless steel "S" hooks and attached to the racks.

Fire is started in the firebox about one hour prior to hanging the fish. Charcoal briquets are used to start the fire and green or wet hardwood is added to provide the smoke. In the Pascagoula area, pecan wood, various oaks, hickory, and cherry are suitable.

With some species of fish, a low-temperature smoke is of utmost importance in producing a product with a moist texture and a good smoky flavor. High temperatures result in drying, toughness, and extreme loss of weight. On the other hand, fish such as mullet is best smoked at temperatures from 130° to 180° F. Twelve hours is required to properly smoke small mullet to a golden brown color.

Mullet prepared as indicated here were served to a taste panel of local citizens. The principal criticism was that the fish were of small size and had excessive bones. They nevertheless were well accepted.

SUMMARY

A fish smokehouse was constructed from $45 worth of materials in 16 hours, utilizing unskilled labor.

Approximately 150 pounds (240 mullet) were smoked in one operation in this smokehouse, producing a product acceptable to a taste panel of local citizens.

The plans may be expanded to construct a larger smokehouse, but it is desirable first to gain experience with a smaller smokehouse such as this one.

LITERATURE CITED

BRAWNER, JACK T., and A'BRAMS, PHILLIP
1956. How to Produce and Sell Smoked Florida Mullet. Educational Series No. 8, p. 9. The Marine Laboratory, University of Miami, Coral Gables, Fla.

SEAFOOD MERCHANDISING
1959. A New Day for the Mullet. Seafood Merchandising, vol. 19, No. 10, p. 12, New Orleans, La.