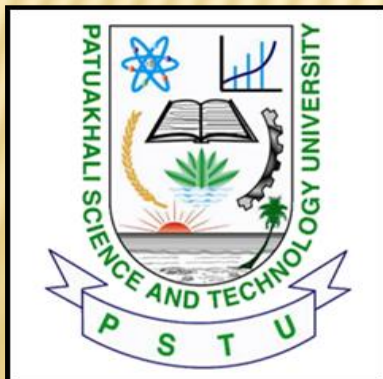


# Comparative Quality Assessment of Traditionally vs. UC Davis Solar Chimney Dryer Produced Dried Bombay duck (*Harpadon nehereus*): Scaling-up of Safe and Quality Dried Fish in Bangladesh



## Presented By

Md. Sazedul Hoque, Ph.D.

Associate Professor & Chairman

Department of Fisheries Technology

Patuakhali Science & Technology University, Bangladesh

Email: [sazedul.fst@pstua.c.bd](mailto:sazedul.fst@pstua.c.bd); Cell: +8801716244719

❖ **Fisheries sectors:**

World production-5<sup>th</sup> (41.34 lakh MT)

National GDP 3.61%

Agricultural GDP 24.41%

❖ **Fish Drying: Low-cost & Traditional Method**

❖ **Dried fish limitation:**

Longer drying time

Insect infestation, Insecticides and pesticides

Microbial contamination

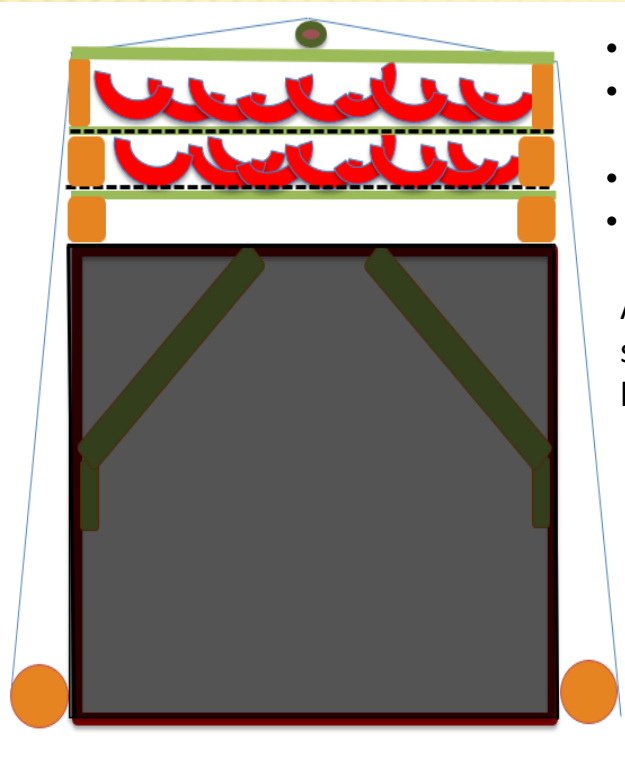
Lack of sanitation and hygiene

❖ **UC Davis Chimney solar dryer:** Low-cost improved technology

# OBJECTIVES

- ❖ To conduct training for entrepreneurship and skills development for quality dried fish through UC Davis chimney dryer;
- ❖ To compare quality (sensory, microbial and biochemical) of dried fish produced from improved (UC Davis chimney dryer) and traditional method and stored under different packaging condition;
- ❖ Modify the design of UC Davis chimney dryer for extended production capacity

# UC DAVIS CHIMNEY SOLAR DRYER

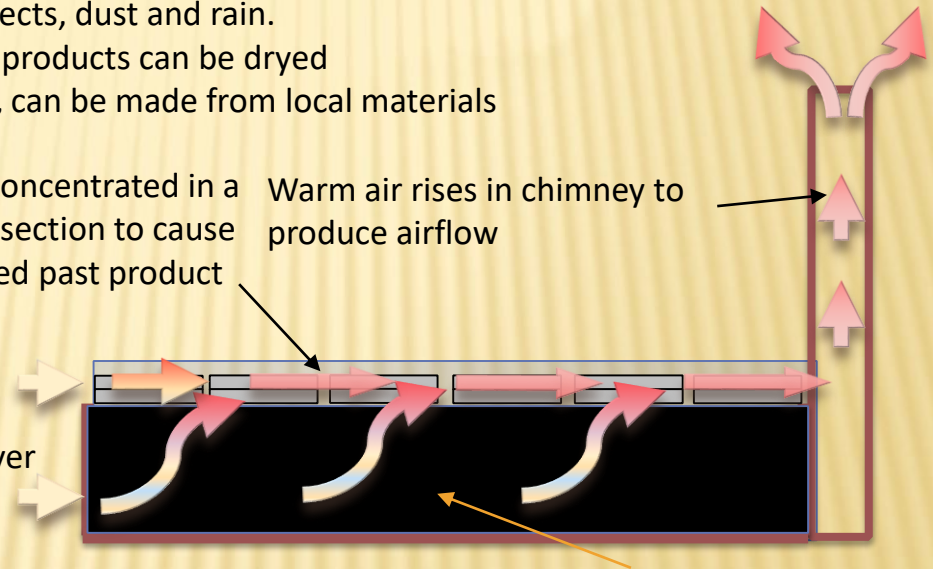


- Faster drying compared to other designs or traditional drying
- Plastic cover protects food products from contamination of pests, insects, dust and rain.
- Different products can be dried
- Low-cost, can be made from local materials

Air flow is concentrated in a small cross section to cause high airspeed past product

Warm air rises in chimney to produce airflow

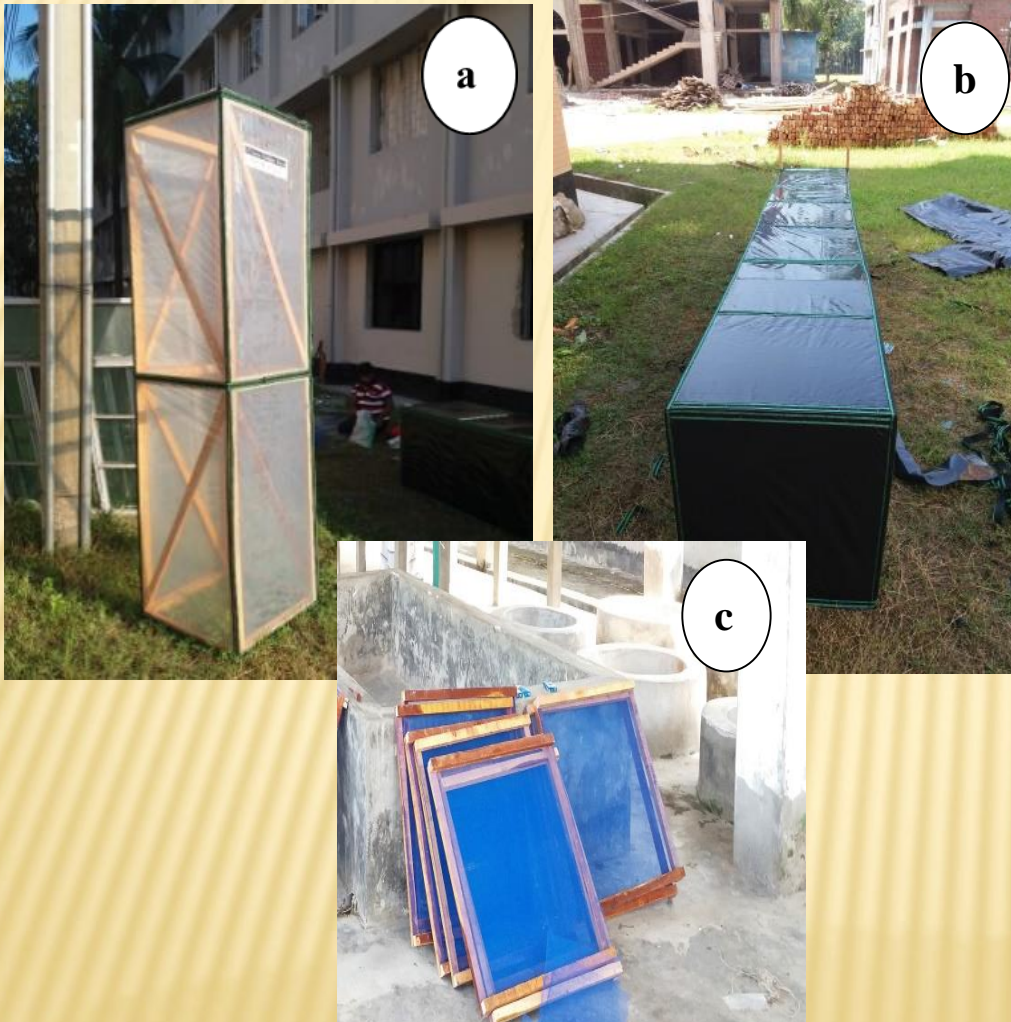
Air enters front of dryer



Approximate materials cost in Bangladesh: \$120

80 cm high 'table' covered with black plastic or cloth. Clear plastic film is placed over the trays and the sides of the table.

# UC Davis chimney solar dryer :



**Figure 2: UC Davis chimney solar dryer ;  
(a) chimney structure, (b) drying table, and (c) tray**

## Tools/Materials:

Scrap wood, nylon net, polythene, saw, hammer, scissors, drill box, stapler, staples, screws, measuring tape.



**Figure 3: UC Davis chimney solar dryer**

# 1<sup>ST</sup>: ECOFISH, WORLDFISH



**Study period:** February, 2017 to January, 2018.

**Study area:** Nidrar char of Taltoli upazila under Barguna district.

- ❖ **Identification and selection of fisher community**  
100 beneficiaries (76 women and 24 men)
- ❖ **Formation of community based organization (CBO)**  
Total four (4) groups (CBOs) (25 members each)
- ❖ **Conduct training**



**Figure 4: Conduct training session; (a) lecturing on dried fish, (b) demonstration of UC Davis chimney dryer**

## Dried fish sample

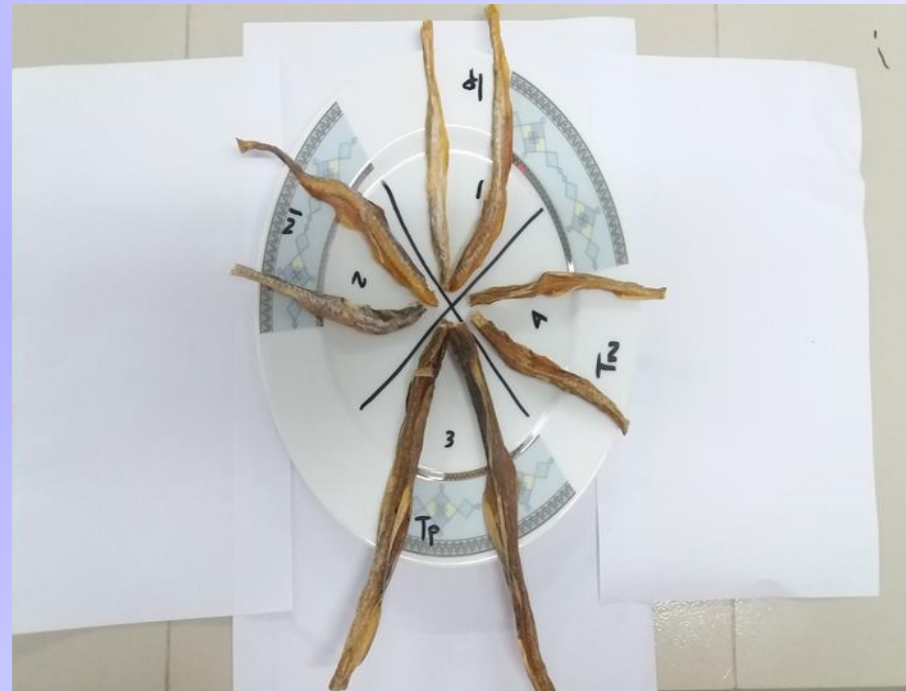
- ❖ Traditional dried fish collected from Kuakata.
- ❖ Fresh Bombay duck fish collected from Kuakata.



**Figure 5: Dried fish sample; (a) Traditionally produced in Kuakata, (b) UC Davis Chimney Dryer using by MS student at PSTU**

# Quality analysis: Sensory quality

The sensory quality was analyzed based on quality index method (Howgate *et al.* 1992).

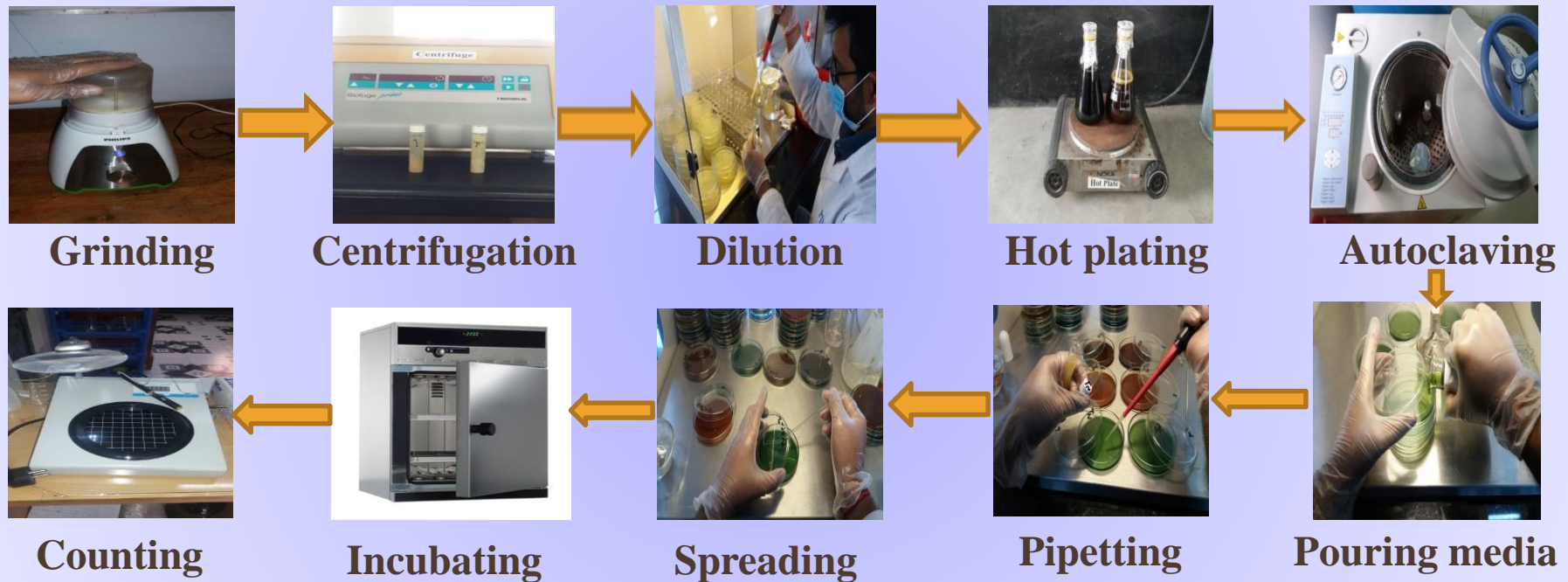


**Figure 6: Sensory analysis; (a) sensory panellists and (b) dried fish sample.**



# Quality analysis: **Microbial quality**

Standard plate count (SPC) was adopted for bacteriological study Cappuccino and Sherman (1992).



**Figure 7: Flow chart of microbial analysis.**

# Quality analysis: Bio-chemical quality

Proximate composition: AOAC (2000)



**Muffle furnaces**

↓  
**Ash**



**Hot air oven**

↓  
**Moisture**



**Kjeldahl unit**

↓  
**Protein**



**Soxhlet extractor**

↓  
**Lipid & TVBN**

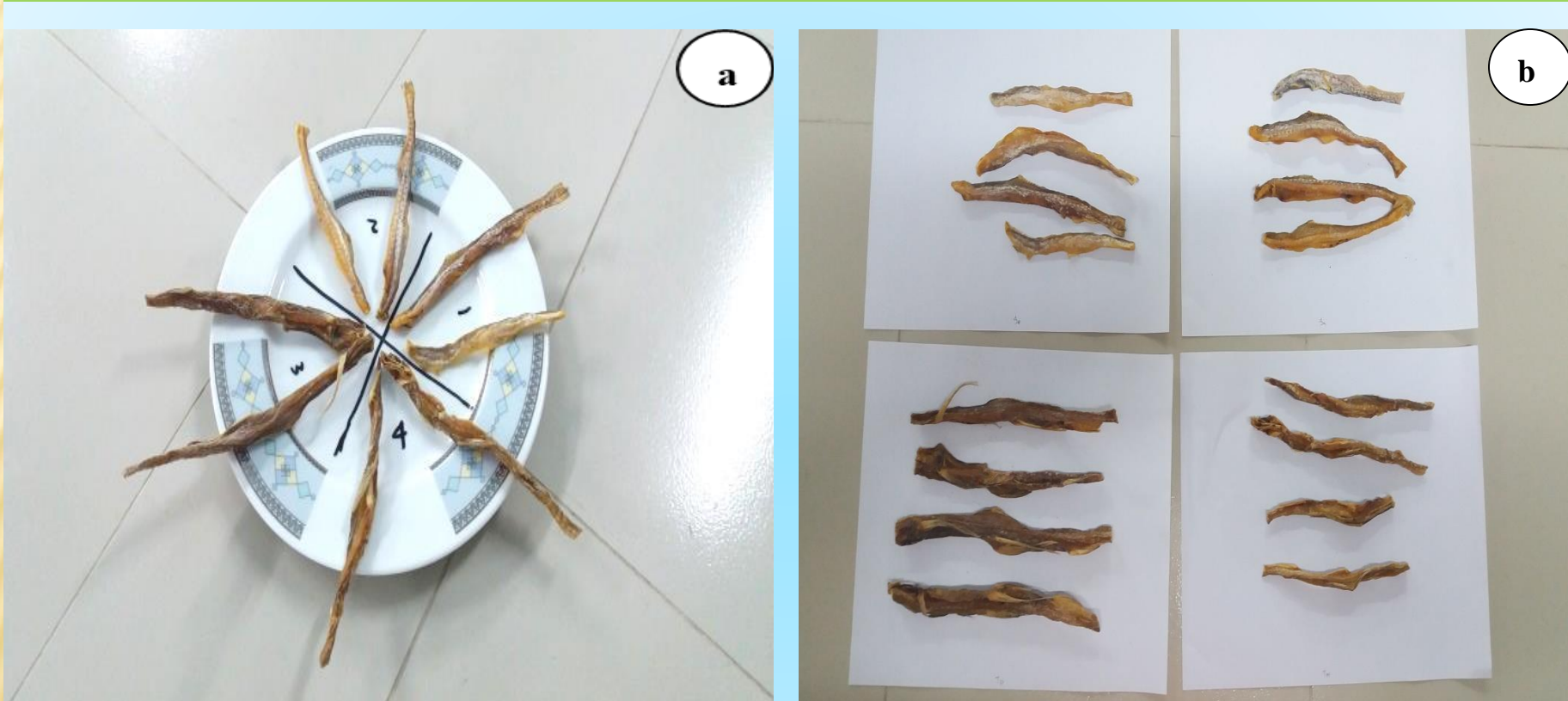
**Figure 8: Bio-chemical analysis instrument.**

# RESULTS: Sensory Analysis

**Table 1: Organoleptic characteristics of traditional and improved Bombay duck (*Harpadon nehereus*) dried fish during different storage time.**

Organoleptic characteristics	Initial time (0 days)		Storage time (60 days)			
	Traditional	Improved	Traditional		Improved	
			Sterile Packed	Polyethylene packed	Sterile Packed	Polyethylene Packed
<b>Colour</b>	Blackish inner & dark brown outside	Whitish & shiny	Blackish inner & dark brown outside	Blackish inner & dark brown outside	Off white to yellowish	Yellowish to light brownish
<b>Odour</b>	Moderate dried fishy	Natural dried fishy	Moderate dried fishy	Slight decomposed	Natural dried fishy	Bland
<b>Texture</b>	Firm, tender & hard	Firm, tender & flexible	Slight soft	Moderate soft	Firm, tender & flexible	Firm, tender & flexible
<b>Flavour</b>	Moderate	Natural salty	Moderate	Strong	Natural salty	Natural salty
<b>Insect Infestation</b>	No insect infestation	No insect infestation	No insect infestation	No insect infestation	No insect infestation	No insect infestation
<b>General appearance</b>	Moderate good	Excellent	Moderate good	Bad	Excellent	Good
<b>Over all acceptability</b>	Moderately acceptable	Highly acceptable	Moderately acceptable	Slightly unacceptable	Highly acceptable	Highly acceptable
<b>Defect point</b>	2.42	1	2.71	3	1.28	1.57
<b>Grade</b>	B	A	B	B	A	A
<b>Grade characteristics</b>	Good/acceptable	Excellent , Highly acceptable	Good/acceptable	Good/acceptable	Excellent , Highly acceptable	Excellent , Highly acceptable

# RESULTS: Sensory Analysis



**Figure 9: Sensory quality analysis of Bombay duck (*Harpadon nehereus*) dried fish; (a) at initial time, (b) at storage time (60 days).**

# RESULTS: Sensory Analysis



**Figure 10: Sensory quality analysis of Bombay duck (*Harpadon nehereus*) dried fish; (a) grinded dried fish at storage time (60 days) and (b) dried fish in sterile and polyethylene packed.**

# RESULTS: Microbiological analysis

*Salmonella typhimurium*, *Salmonella abony*, *Escherichia coli*, *Vibrio cholerae* and *Vibrio parahaemolyticus*.

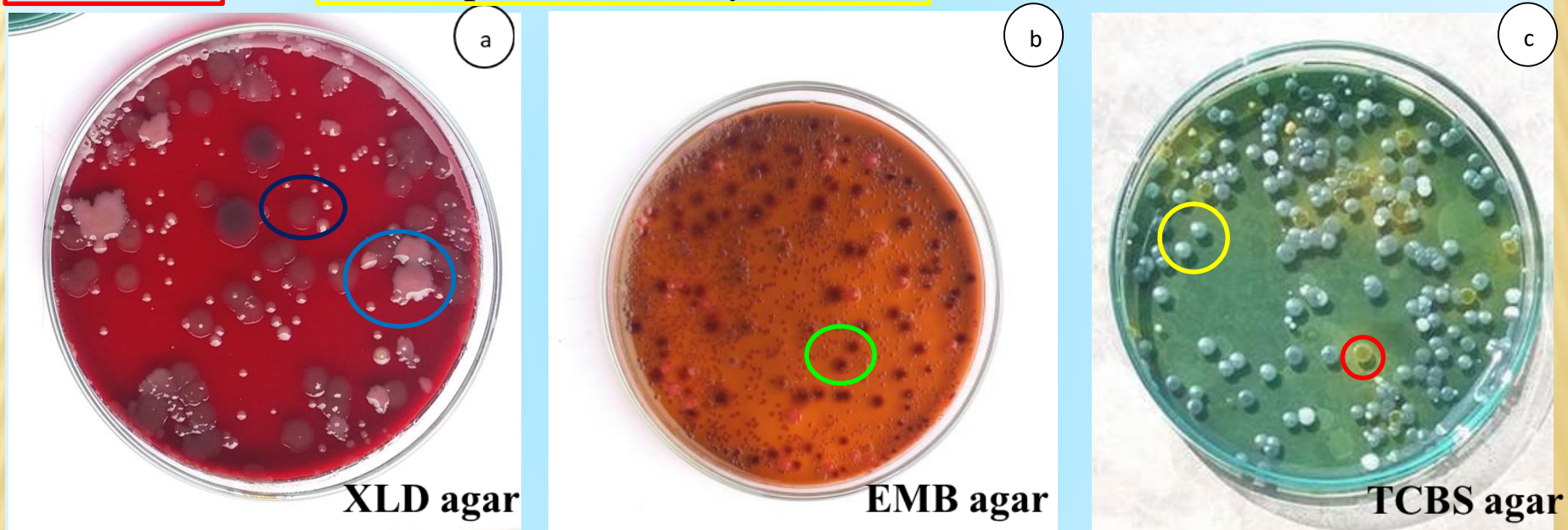


Figure 11: Bacterial colony in different selective agar media, (a) *Salmonella* spp in XLD agar with colorless or pale pink colony (b) *E. coli* in EMB agar with purple with black center and (c) *Vibrio* spp in TCBS agar with yellow and bluish green colony.

# RESULTS: Microbiological analysis

Table 2: Microbiological characteristic of traditional and improved Bombay duck (*Harpadon nehereus*) dried fish during different storage time.

Microbial parameter	Initial time (0 days)		Storage time (60 days)				Permeable load in dried fish
	Traditional	Improved	Traditional		Improved		
			Sterile Packed	Polyethylene packed	Sterile Packed	Polyethylene packed	
APC	$7.72 \times 10^7 \pm 1.59$	$4.32 \times 10^4 \pm 1.07$	$3.9 \times 10^5 \pm 0.60$	$5.6 \times 10^6 \pm 1.30$	$2.3 \times 10^3 \pm 0.84$	$4.8 \times 10^4 \pm 0.30$	$\leq 10^5$ cfu/gm
TSC	$5.0 \times 10^4 \pm 1.10$	Absent	$3.0 \times 10^3 \pm 0.90$	$4.7 \times 10^4 \pm 1.27$	Absent	$0.5 \times 10^1 \pm 0.30$	0 cfu/gm
TEC	$4.8 \times 10^5 \pm 1.2$	$2.6 \times 10^2 \pm 1.00$	$2.8 \times 10^3 \pm 0.29$	$3.6 \times 10^4 \pm 0.60$	Absent	$1.0 \times 10^2 \pm 0.01$	$\leq 500$ cfu/gm
TViC	$3.9 \times 10^3 \pm 0.40$	$1.3 \times 10^2 \pm 0.30$	$1.8 \times 10^3 \pm 0.20$	$2.7 \times 10^4 \pm 0.45$	Absent	$0.9 \times 10^2 \pm 0.10$	$\leq 10^2$ cfu/gm

APC, Aerobic plate count; TSC, Total Salmonella count; TEC, Total *E.coli* count; TViC, Total Vibrio count.

# RESULTS: Biochemical analysis

Table 3: Biochemical characteristic of traditional and improved dried Bombay duck (*Harpadon nehereus*) fish during different storage time.

Biochemical characteristics (%)	Initial time (0 day)		Storage time (60 days)			
	Traditional	Improved	Traditional		Improved	
			Sterile Packed	Polyethylene packed	Sterile Packed	Polyethylene Packed
<b>Protein</b>	44±2.41	43±0.9	50.75±0.01	45.25±1.43	49.87±1.79	44.7±1.27
<b>Lipid</b>	4±0.04	5±0.4	1±0.60	1±0.9	2±0.81	2±1.83
<b>Ash</b>	24.53±0.47	23.67±1.56	22.45±0.9	24.56±2.34	21.50±0.89	24.12±1.57
<b>Moisture</b>	29.40±1.40	26.88±0.98	28.77±1.13	29.46±2.29	26.80±2.07	29.19±1.4
<b>TVBN (mgN/100g)</b>	-	-	0.16±0.01	0.15±0.01	0.04±0.02	0.14±0.01



## Summary of Comparative Quality Study

---

Sensory, Microbial and Biochemical Quality:

- ❖ Dried fish produced using **UC Davis chimney solar dryer** better compared to traditional one.
- ❖ **Improved method & packaging** (sterile package) extend shelf-life and produced safe dried fish than Traditional & Normal PE.

# 2<sup>ND</sup>: MINISTRY OF SCIENCE & TECHNOLOGY, GOB



**Study period:** July 2017 to June 2018.  
**Study area:** at Mahipur in Patuakhali.



# LIMITATIONS OF UC DAVIS CHIMNEY DRYER

Comments from Barguna & Patuakhali



Lower  
production  
capacity!!!

# 3<sup>rd</sup>: Modified UC Davis Chimney Dryer for higher capacity

@ PSTU in March 2019

Horticulture Innovation Lab, Worldfish



4<sup>TH</sup>

WFP & WorldFish EFSN Project:

23 UC Davis Chimney Dryer;

2 days (T+P) ToT for 50 Shushilon NGO at Teknaf & 50 Rick NGO Ukhiya at Cox's Bazar



# 5<sup>TH</sup> ECOFISH, WORLDFISH



- Prepare 3 UC Davis Chimney
- Dryer Conduct 3 days Training on Safe and Quality Dried fish
- @ Shah Porir Deep and Shaplapur, Teknaf, Cox's Bazar



# LAST....

---

✘ **Proposed project (at final stage) to Bangladesh Academy of Science (BAS):**

‘Quality dried fish and fish powder for nutritional support to pregnant, lactating women and children in Southern Bangladesh’

(proposed technology also UC Davis Chimney Dryer, here!!)

# ACKNOWLEDGEMENTS

- ❖ WorldFish (ECOFISH<sup>BD</sup> Project), South-Asia, Bangladesh
- ❖ Ministry of Science and Technology, Bangladesh
- ❖ UC Davis, Horticulture Innovation Lab, University California Davis
- ❖ Patuakhali Science and Technology University, Bangladesh





**THANK YOU ALL  
FOR YOUR KIND ATTENTION**

