Descriptive aroma changes in selected Philippine virgin coconut oil (VCO) during storage at elevated temperatures

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VIRGIN COCONUT OIL (VCO)

Obtained from fresh mature coconut kernel processed by mechanical or natural means, with or without application of heat, while **maintaining the natural state of the oil** [1].

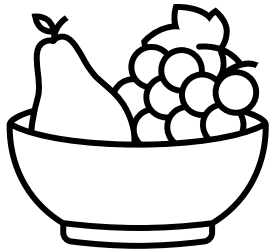
Image source: https://www.indiamart.com/proddetail/coconut-oil-21138146948.html

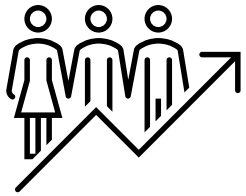
A **functional food** with impressive health benefits such as [2]:

- **Stimulates metabolism** because of medium-chain fatty acids,
- **Supports the immune system** due to rich amount of lauric acid,
- **Helps keep diabetes in check** by improving insulin secretion,
- Helps with **weight loss**.

On-going clinical study in the Philippines also shows the potential of VCO to **reduce coronavirus load by 60-90% for <u>mild cases</u>** of COVID19 [3].

Global Demand…





The global demand for VCO is **expected to grow by 2.5%** in the next 5 years. The increasing health-conscious consumers boosted the growth of VCO for its impressive health benefits to maintain good health and lifestyle [4].

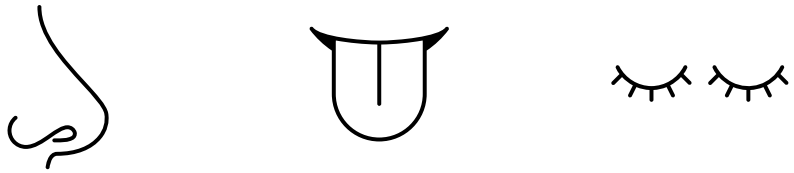
Export Commodity

Image source: https://vemaps.com/philippines

Philippines is one of the major exporters of VCO, a premium export commodity of the country [2].

The rising global demand for this commodity challenges the need to **maintain the quality parameters**, such as sensory properties especially during storage, of VCO.

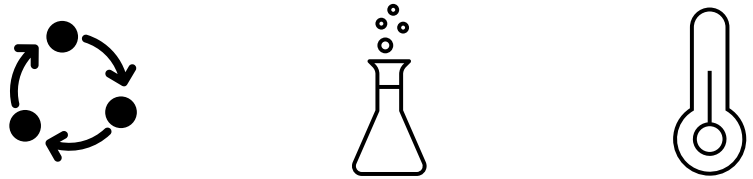
Descriptive Sensory Properties



Descriptive sensory properties is one of the parameters which may help maintain the quality of VCO

It distinguishes VCO from other coconut oil, as well as differentiate its various processes .

It also **reflects the type of process** the oil is produced with, as the production retains its natural state [2].



Volatile organic compounds, present in the oil, contribute to the sensory profile of VCO which can be affected by external factors such as variation of storage conditions especially at the consumers' end [5].

OBJECTIVE OF THE STUDY

The study aimed **to determine the changes in the descriptive aroma profile** of three (3) differently processed VCO stored under **elevated temperatures**.

Ethical Consideration

Ethical clearance (**NEC Code: 2019-001-Villarino-VCO**) was approved by the National Ethics Board of the Department of Science and Technology – Philippine Council for Health Research and Development.

VCO Samples

- Three (3) differently processed (i.e. **fermented, centrifuged, expeller-pressed**) VCO samples were used.
- Obtained from local VCO producers from Quezon Province and Laguna, Philippines.
- Stored in incubators (IN260 Memmert, Germany) at elevated temperatures of **35°C, 40°C,** and **45°C.**
- Evaluated by **trained panelists**.

Panelists

- Eight (8) trained panelists
- 6 females, 2 males
- Ages 24-56 years.

Panelists were recruited and selected from a three-phase screening process; taste recognition, odor recognition, and intensity ranking tests [6].

Training

- Generic descriptive method [1,6] was used to train and evaluate VCO samples.
- A total of 30 hours (15 sessions) was conducted to determine perceivable aroma, refine the standard references, techniques for evaluation and calibration of the panel.

Training

Table 1. Activities for each training sessions

Session	Activity
0	Orientation of the panelists (introduction to the study, samples and the sensory evaluation protocols)
1	Refining descriptors
2-10	Establishment of reference standards
11-15	Calibration, refining, and polishing of panel performance

Table 2. Definition of descriptors used by the trained panel to describe virgin coconut oil

Descriptor	Definition
Nutty	The aroma associated with the 2nd layer of fresh coconut kernel with *testa*
Latik	The aroma associated with cooked, sweet, coagulated coconut milk
Acid	The aroma associated with acetic acid solution
Rancid	The aroma associated with old, unpleasant, soapy, acrid oil

Sample Evaluation

A 7mL sample was presented in 30 mL-capacity glass containers with screw caps, coded with 3-digit random numbers, maintained at room temperature (30±2°C).

Samples consisting of **six (6) VCO samples** were presented in a **clean tray lined with white bond paper** together with **reference standards** for aroma, and a tablet device for the developed web-application for the **answer sheet** of the panelists.

Sample Evaluation

Before evaluation:
Panelists were advised to avoid scented products and were instructed to use the provided unscented cleansing soap (Cetaphil, USA) to wash hands to remove unnecessary scent.

During evaluation:
1. First smelled the back of the palm to clear their nose.
2. Swirled the first sample bottle five times clockwise, five times counter clockwise making sure the oil reached the neck of the bottle.
3. Unscrewed the cap near their nose.
4. Tilted the opened bottle 45° towards their nose level.
5. Did three quick sniffs.
6. Evaluated the samples within five seconds.

Elevated Temperature Storage

Samples were stored in three varying temperatures with six different sampling points per temperatures based on a **Q_{10} of 2 for lipid oxidation** [7].

Table 3. Sampling interval for elevated storage temperatures.

Temperature (° C)	**Sampling point (days)**
35	0, 42, 84, 126, 168, 210, 255
40	0, 30, 60, 90, 120, 150, 180
45	0, 21, 42, 63, 84, 105, 127

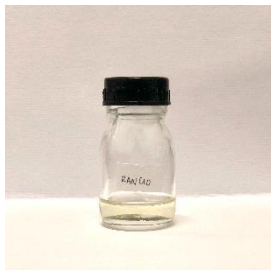
Aroma Profile

Reference standards for the descriptive aroma of VCO


Nutty


Latik

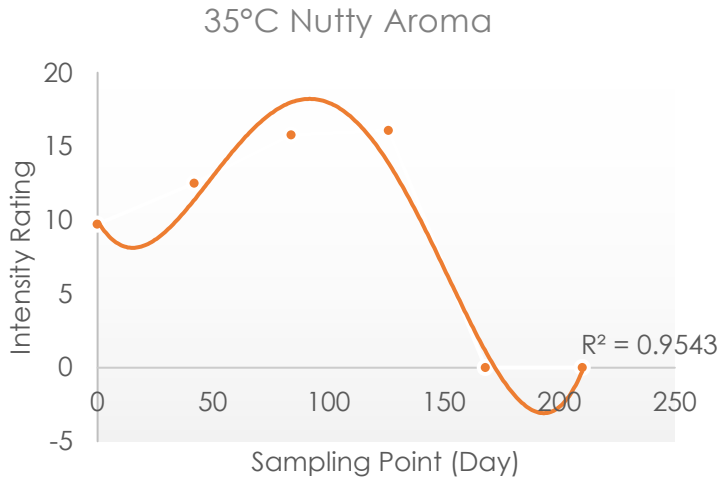

Acid

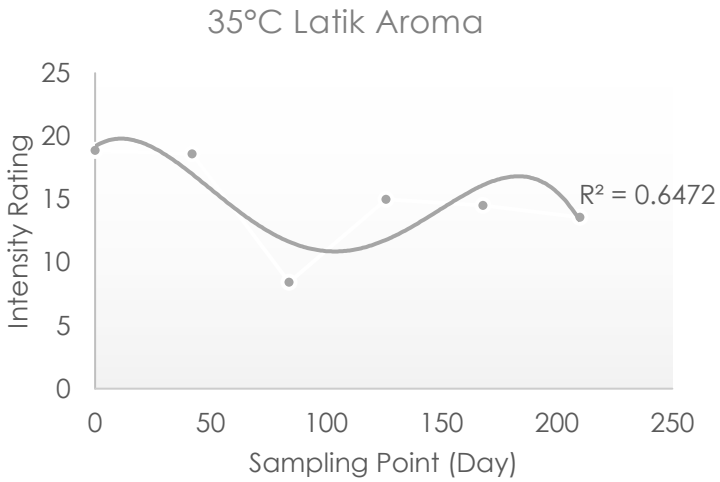

Rancid

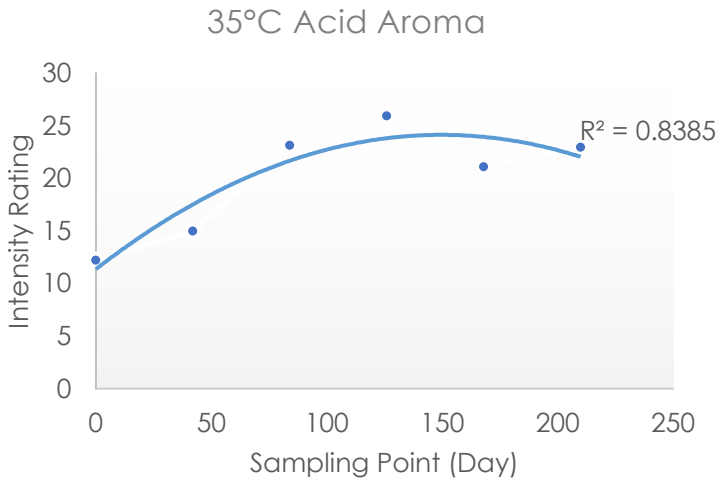
VCO samples were initially evaluated to have **predominant aroma profile based on the process** they were produced with. Centrifuged VCO was initially described to have predominant nutty aroma while expeller-pressed was described to have predominant *latik*. Meanwhile, fermented samples initially exhibited acid aroma,

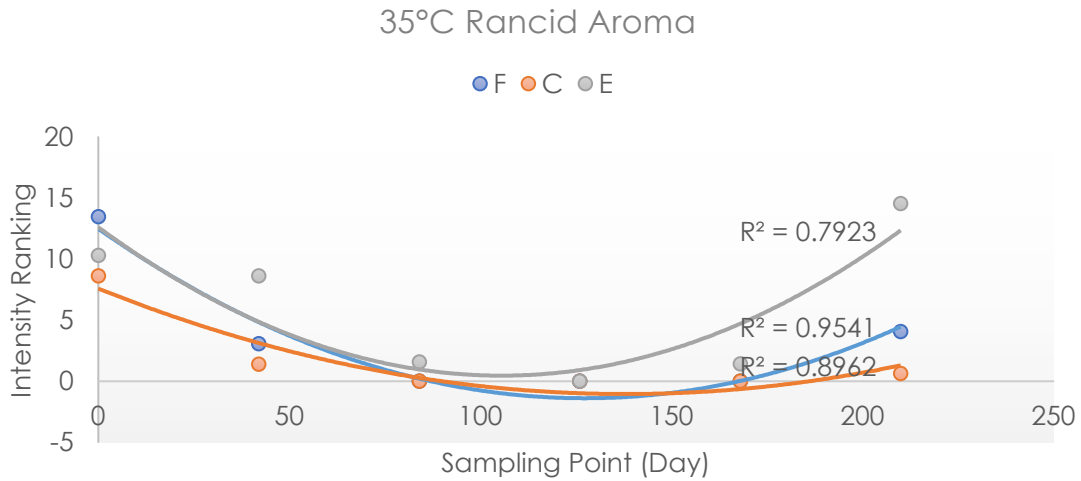
Sample Evaluation

- **Elevated storage temperature: 35° C**





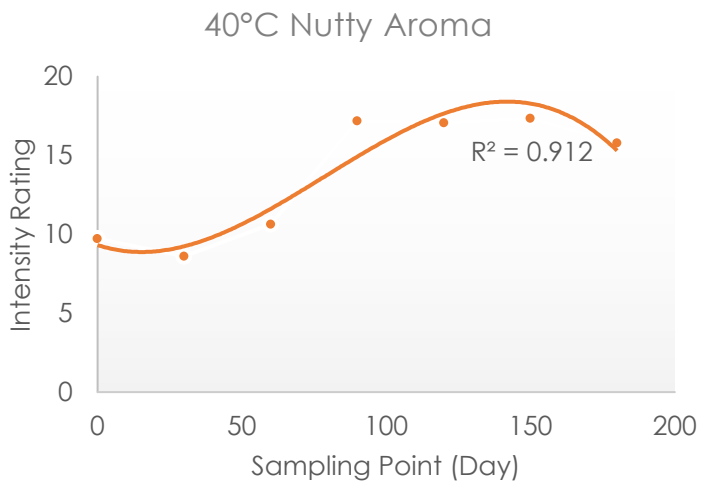


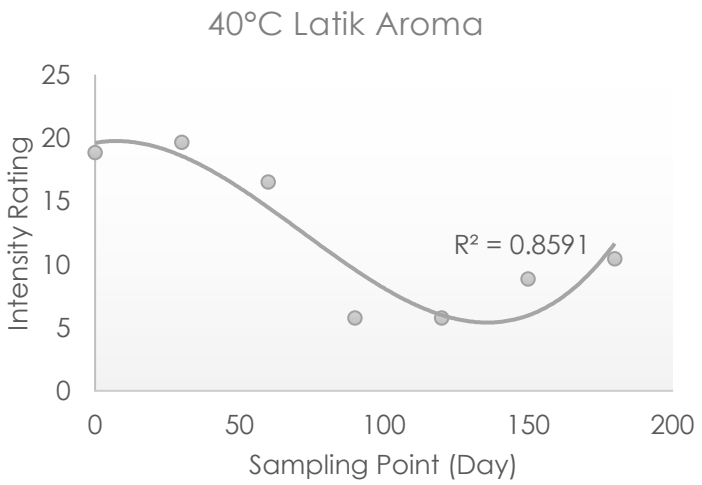


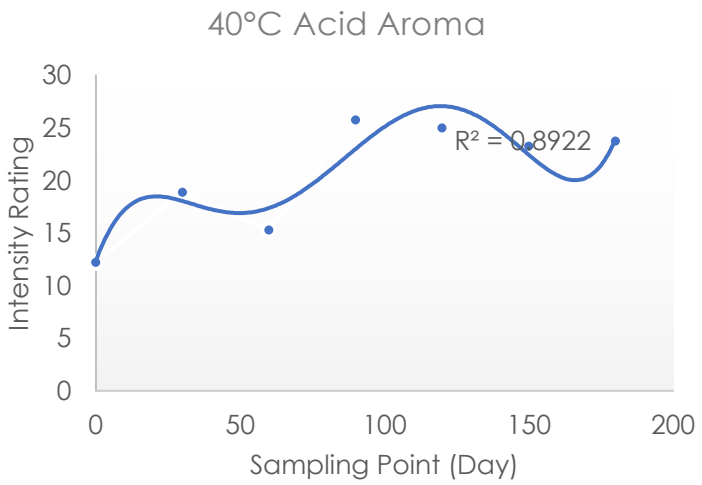
RESULTS AND DISCUSSION

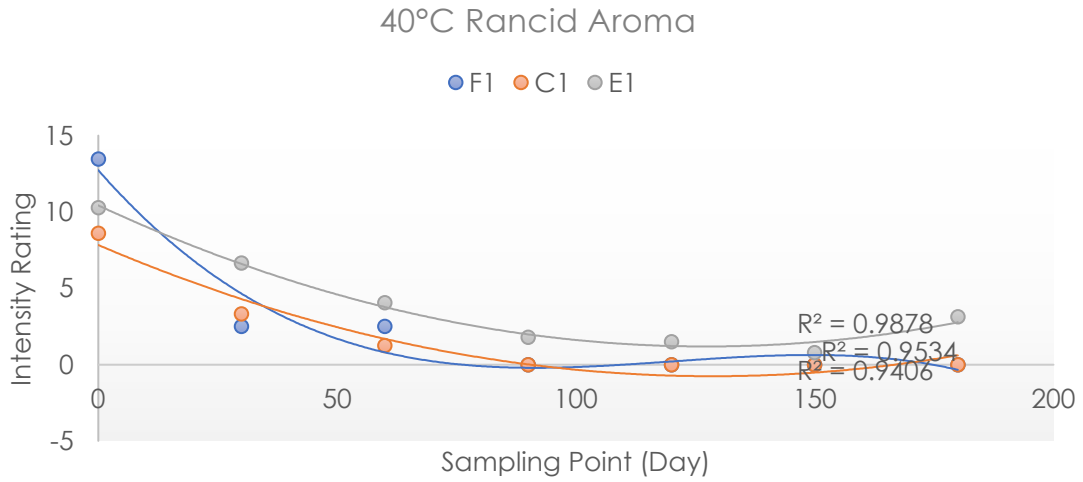
Sample Evaluation

- **Elevated storage temperature: 40°C**





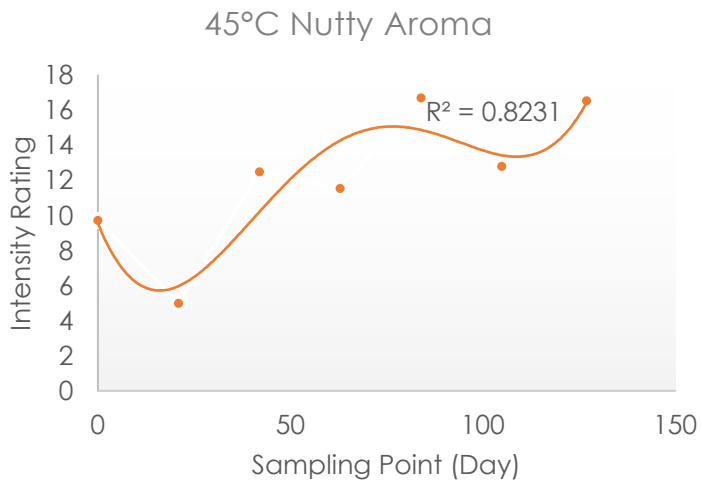


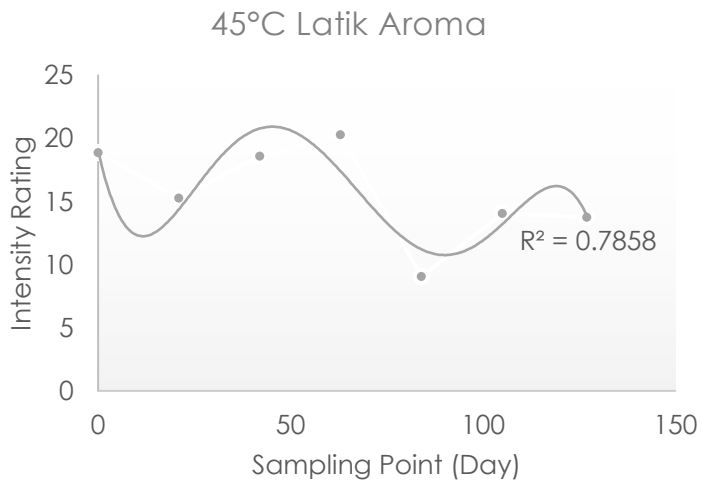


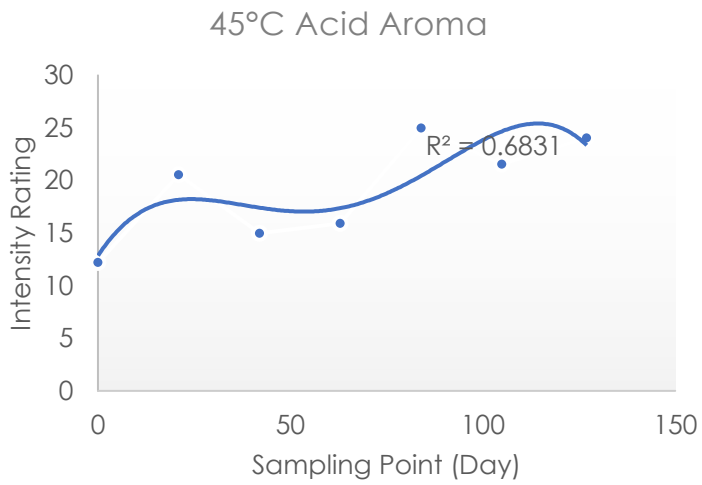
RESULTS AND DISCUSSION

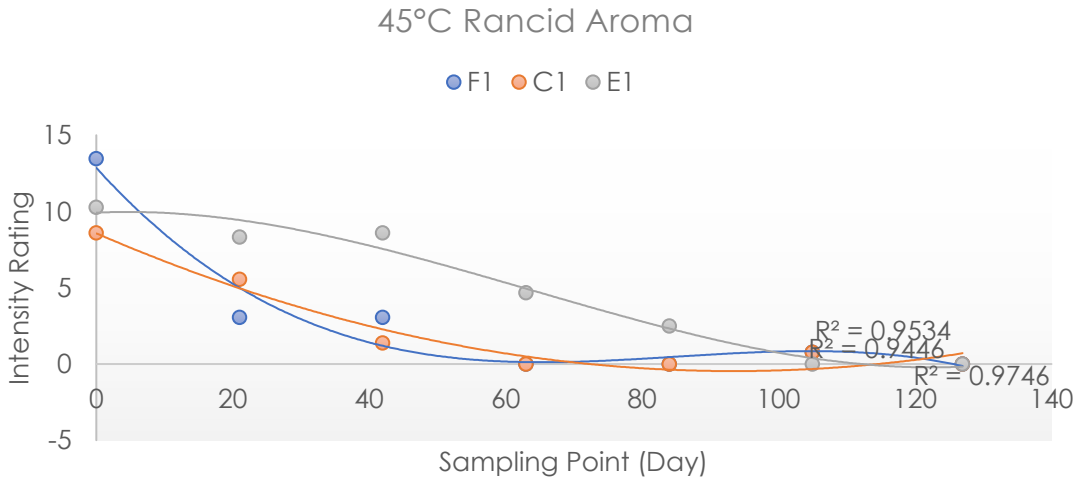
Sample Evaluation

- **Elevated storage temperature: 45° C**









CONCLUSION

- The **changes in the aroma** of the VCO samples stored at varying elevated temperatures exhibited **polynomial behavior during storage**.
- At the initial stages of storage, **aroma perception increased followed by a decline** which may be due to the **volatilization of the volatile organic compounds** responsible for the aroma perceived in VCO samples.
- **Rancid aroma** intensity of samples surprisingly **decreased**, except for expeller-pressed VCO stored at 35°C, which can be due to the volatilization of free fatty acids responsible for the rancid aroma [5]. This observation may also be attributed to the **depletion of microbial activity, at higher temperatures**, responsible for hydrolysis of free fatty acid [8] which can result to the detection of rancid aroma.

RECOMMENDATION

It is recommended that **further investigation**, specifically **on the rancid aroma** perception of VCO samples should be conducted as it may have implications on the storage requirements of VCO.

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