

Roadmap to minimizing MOH contamination in cocoa

An industry specification for MOSH and MOAH in jute bags

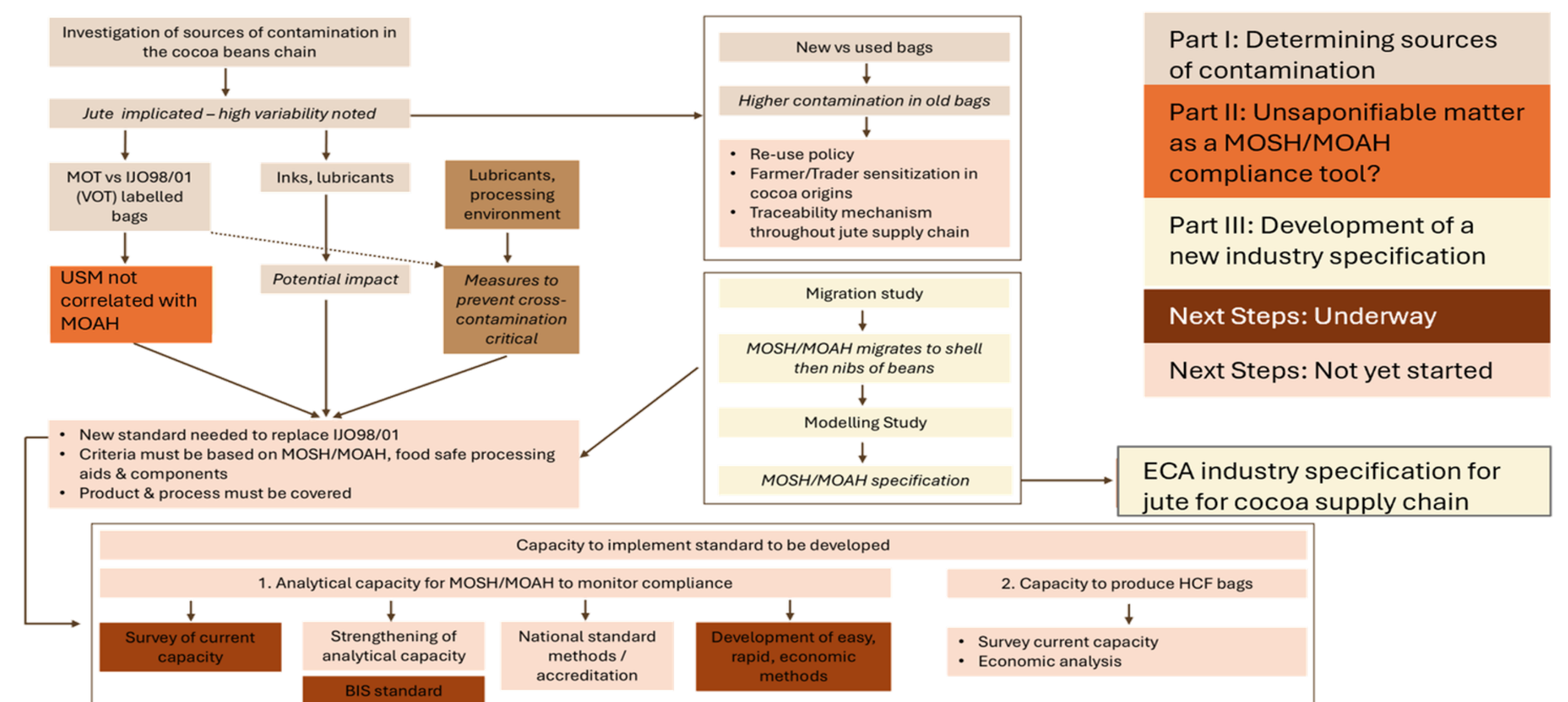
Aleksandra Gorska¹, Michiel Kokken², Michelle End³, Daniel Kadow⁴, Giorgia Purcaro³

¹ Analytical Chemistry Laboratory, Gembloux Agro-Bio Tech, University of Liège, Passage des Déportés 2, Gembloux, 5030, Belgium; ² Olam Food Ingredients, Department Global Quality and Food Safety, Joan Muyskenweg 30T, 1114 AN Amsterdam, the Netherlands; ³ European Cocoa Association asbl, Avenue de Tervuren 168, Box 8, 1150 Brussels, Belgium; ⁴ August Storck KG, Berlin 13403, Germany

CONTEXT AND GOALS

- Jute sacks** are essential in cocoa supply chains due to their durability, breathability, and status as a sustainable packaging solution.
- To ensure food safety, all jute sacks used for cocoa beans must adhere to the **international standard for cocoa jute bags (IJO 98/01)** which was established in 1998 and defined maximum tolerance levels for hydrocarbon residues based on analysis of unsaponifiable material. The standard specifies that all batching oils used in the preparation of **jute shall be non-toxic** and not contain compounds that could produce off-flavours or off-tastes in food material packed in jute bags.
- However, the detection of MOSH (mineral oil saturated hydrocarbons) and MOAH (mineral oil aromatic hydrocarbons) in cocoa beans suggests that the **current measures** in place to prevent contamination in the cocoa supply chain, including compliance with IJO98/01, **are insufficient to ensure that cocoa products meet the new EU food safety regulatory requirements** when they come into force in 2027.

We are working with the cocoa and jute sectors to develop and implement a roadmap to minimize the risk of MOH-contamination in the cocoa supply chain. Key elements of this are:



PART I – DETERMINING SOURCES OF CONTAMINATION

MOSH/MOAH CONTAMINATION IN VOT AND MOT JUTE BAGS

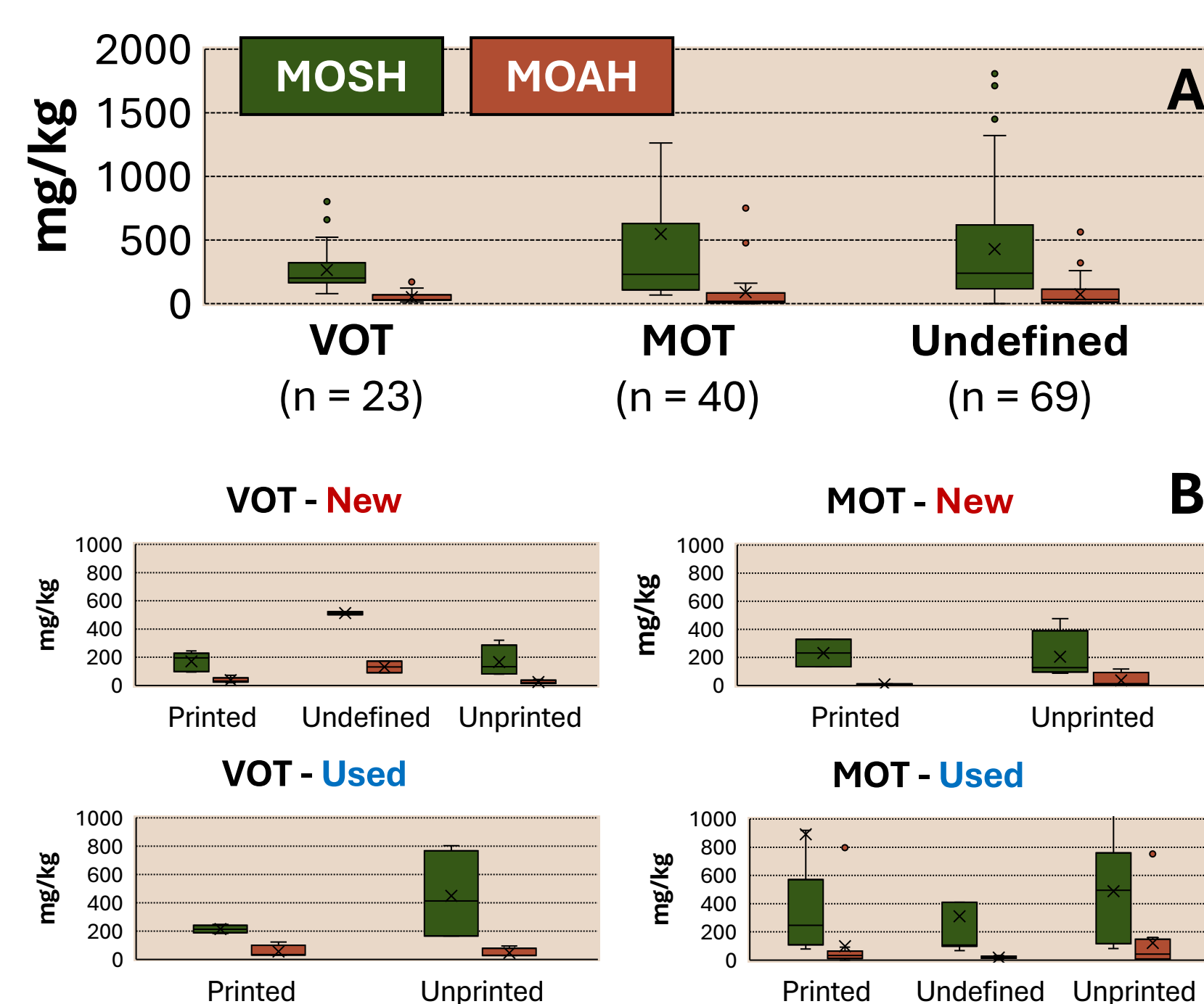


Figure 1 – MOSH and MOAH contents (mg/kg) in vegetable oil-treated (VOT), mineral oil-treated (MOT), and undefined jute bags (A), as well as in sub-groups defined by the level of use (old/new) and the presence of printing (B).

Data collection – Data on MOSH/MOAH content in jute bags was gathered over recent years by companies within the ECA/ Caobisco associations, were evaluated, with 132 samples retained for analysis.

ENTRY POINTS OF MOSH/MOAH IN THE JUTE BAG MANUFACTURING CHAIN

Data collection – VOT jute bag producers were instructed to collect samples of jute fibers and bags at various stages of the processing chain, along with batching oils and printing inks. The MOSH/MOAH content in these samples was subsequently analyzed using LC-GC-FID.

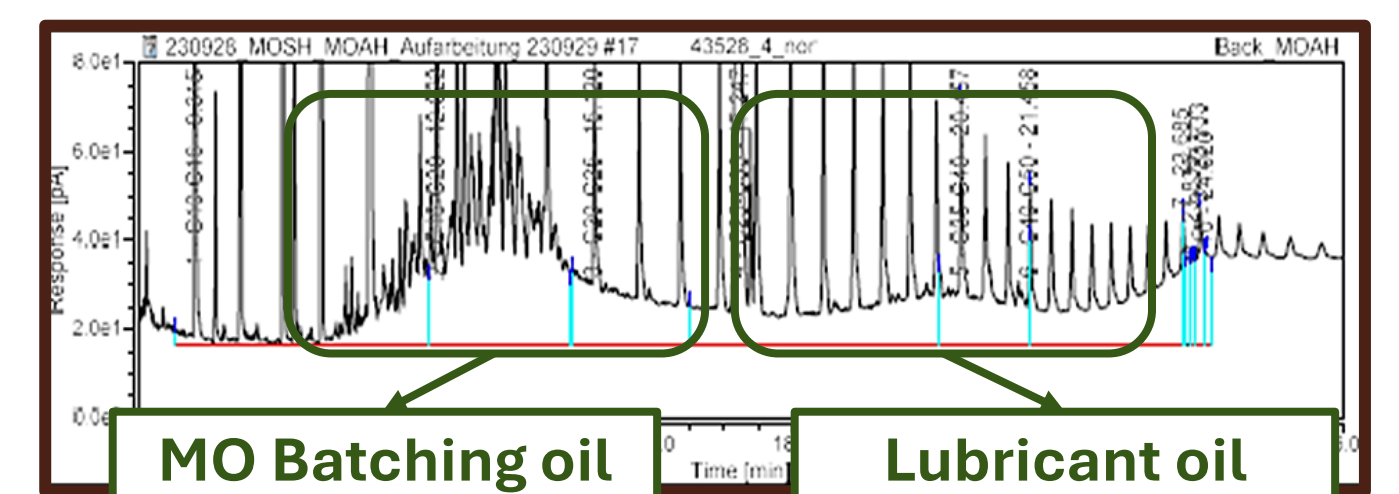


Figure 3 – GC-FID chromatogram of MOSH from a jute bag.

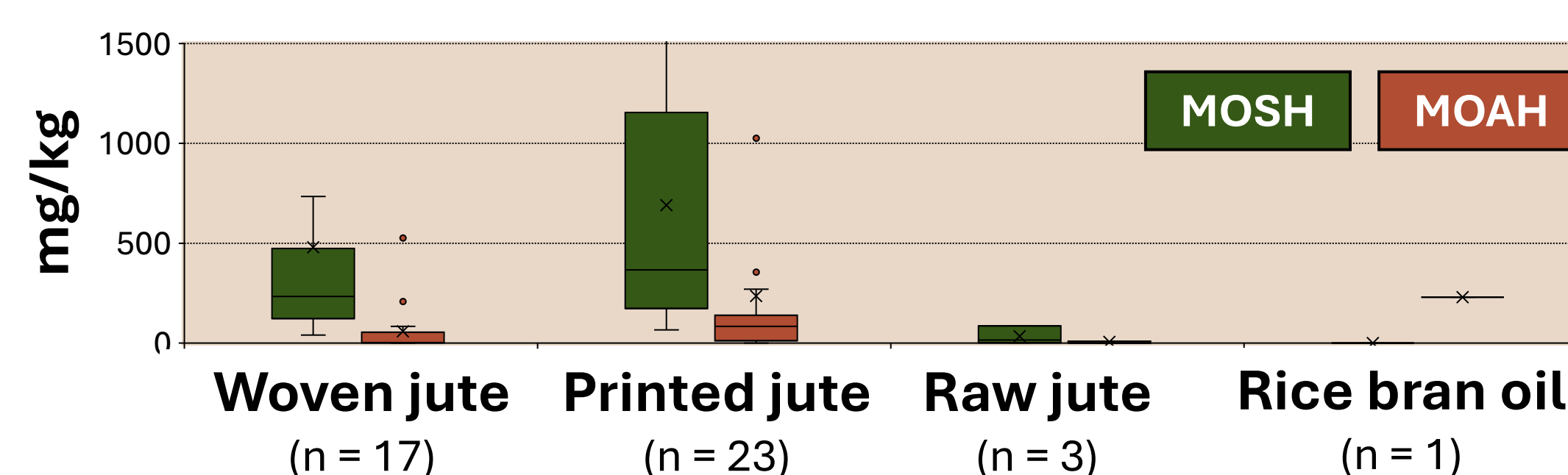


Figure 2 – MOSH and MOAH contents (mg/kg) at various stages of jute bag manufacturing, as well as in a batching oil (rice bran oil, n=1)

The data shows **no significant difference in MOSH/MOAH contamination levels between MOT and VOT jute bags**. While printing inks were not identified as a major source of contamination, attention should be given to ensure all inks are food safe. **Used jute bags exhibited slightly higher contamination levels than new ones**, likely due to poor handling during transport and storage. The **limited number and diversity of samples**, however, restricted definitive conclusions, particularly regarding the role of vegetable batching oils in MOH contamination (n=1). Additionally, some samples showed contamination by **MO batching oil and lubricating oil**, indicating the need for improved measures to prevent cross-contamination during production, storage and transportation or storage practices.

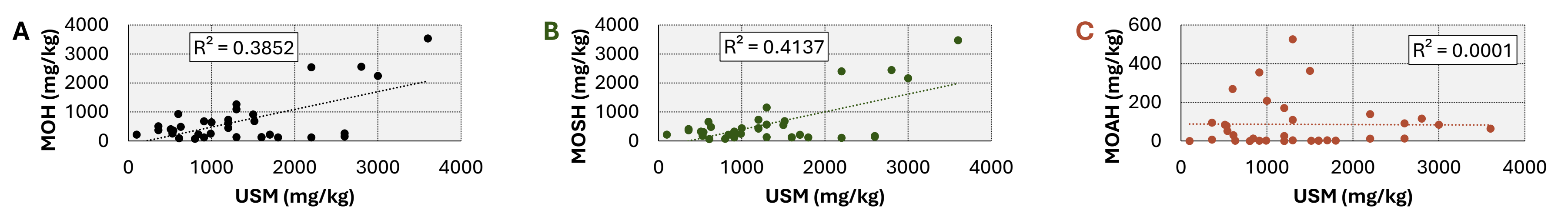
PART II – UNSAPONIFIABLE MATTER AS A MOSH/MOAH COMPLIANCE TOOL?

As recommended by the IJO (1998) and EFSA (2003), a USM content below **1250 mg/kg** is expected to ensure safe levels of MOH contamination in jute bags.

To evaluate the reliability of USM as a compliance tool, its **correlation with MOSH, MOAH, and total MOH levels was assessed**. For visualization purposes their correlation and associated coefficient of determination is shown.

Data collection – The jute bags sampled for goal 2 were analyzed in terms of USM according to the IJO 98/01 Standard Method. The USM was determined in 36 samples.

Figure 4 – USM of jute bags vs. MOH (A), MOSH (B), and MOAH (C) content with regression lines.



A very weak correlation was observed between USM and MOH/MOSH levels, and no correlation was found between USM and MOAH levels, indicating that **USM determination is unsuitable for assessing compliance with MOH contamination limits in jute bags**.

PART III – DEVELOPMENT OF A NEW INDUSTRY SPECIFICATION

The presence of MOSH/MOAH contamination in jute bags, despite expected adherence to IJO 98/01 requirements, highlights the need for stricter controls to ensure that jute used in the cocoa supply chain will not result in MOSH/MOAH levels in cocoa products which exceed the limits to be established by upcoming EU legislation.

A combination of MOSH/MOAH migration data (based on studies performed in 2021) with conversion factors to estimate fat content of cocoa products were employed to estimate the amount of **MOSH/MOAH contamination that could arise in cocoa products from the jute packaging used**.

A new **ECA industry specification** was developed which takes account of the findings from this research and can be used to help minimize MOH contamination from jute used in the cocoa supply chain.

It stipulates that:

- Any substances and materials used, including batching oils, emulsifiers, lubricants, inks and any other components **should be safe for food contact use**, and **will not lead to MOSH/MOAH contamination**. They must not be made from an allergenic source nor lead to off-flavours
- Production and handling of jute should be sufficiently segregated from non-compliant materials in order to minimise the risk of cross-contamination
- Maximum Level MOSH: 250 mg/kg**
- Maximum Level MOAH: 25 mg/kg**
- Determination should be performed using analytical approaches described in the EU JRC guidelines (Bratinova et al. 2023 and any subsequent versions)

Specification available at
eurococoa.com



NEXT STEPS

Project Preparation Grant (ICCO/IJIRA with Support from ECA)
<https://standardsfacility.org/PPG-1090>



ACKNOWLEDGEMENTS

The research has been undertaken by the ECA/CAOBISCO Joint Research Fund and members of the MOH Technical Working Group (an informal group including representatives from the jute sector (public and private sectors from both India and Bangladesh), ICCO, cocoa processors and chocolate manufacturers and their trade and research organizations (ECA, CAOBISCO and their Joint Cocoa Research Fund))