



# ADDING VALUE IN THE MIDDLE: HULLING AND SHELLING

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A close-up photograph of several green almond hulls hanging from a branch. The hulls are oval-shaped and have a slightly textured, greenish-grey surface. They are surrounded by vibrant green, elongated leaves. The background is softly blurred, showing more of the tree and a hint of a person in the distance.

# High Value Options for Hulls and Shells

2020 TAC Biomass Session

Guangwei Huang

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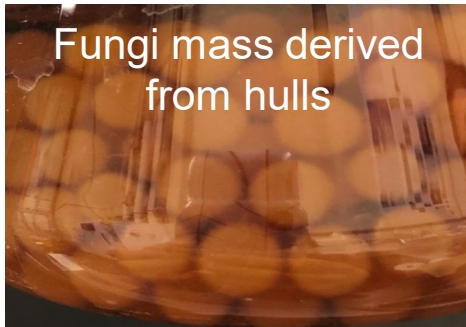
# Under Utilized Hulls for Their Beneficial Properties

- Dairy feed (90%)
- Bedding/mulching (10%)



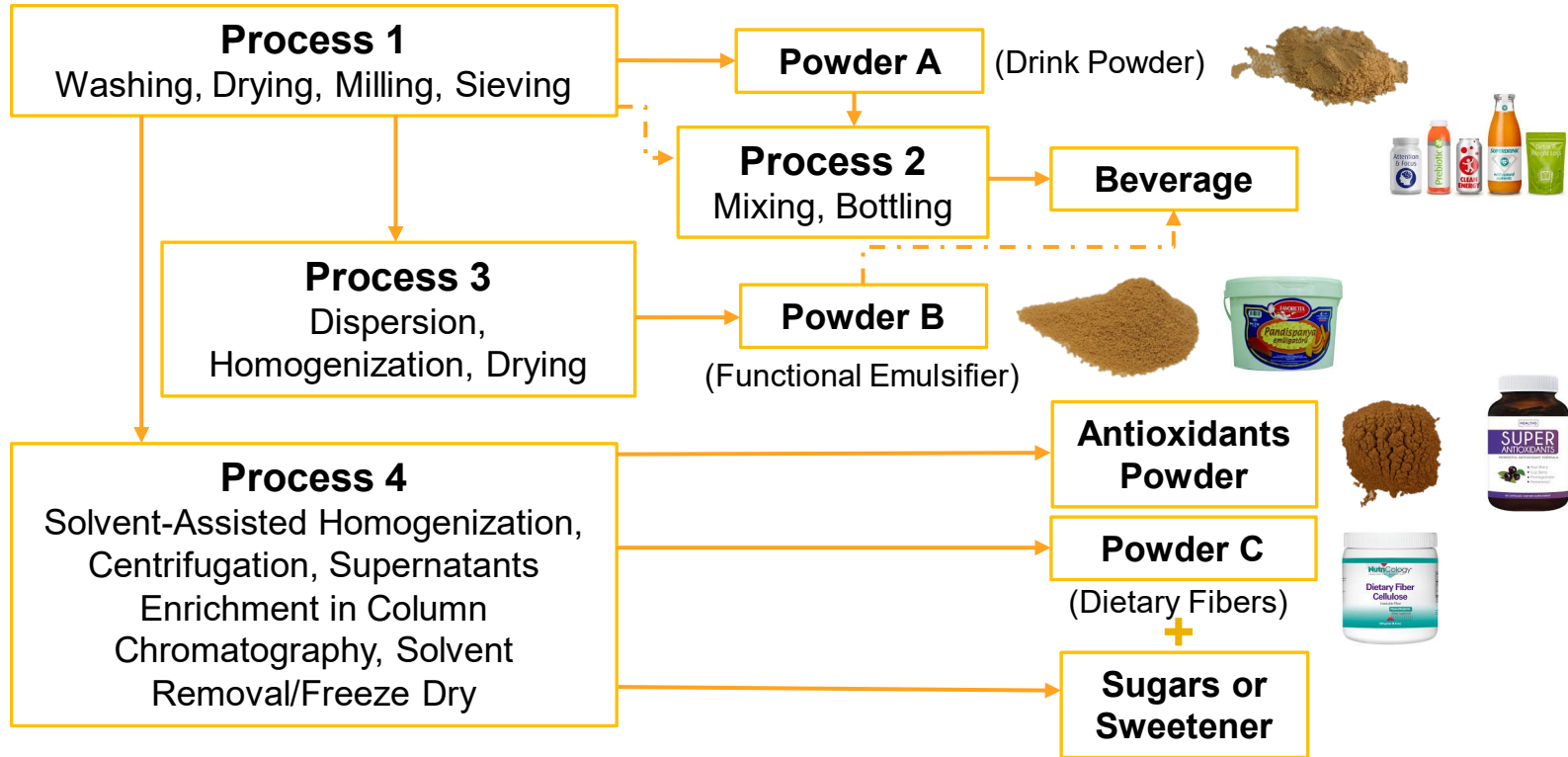
- > 60% water extractives
- More than 32% fibers
- Rich in phytochemicals
- High in minerals

# More Feed Uses for Dairy Cows, Chicken, Fishery





# Hulls Can be Processed into Various Food Ingredients



Ruan, et al., University of Minnesota (2019)

# Shells at a Minimal Value (\$0-10/ton)

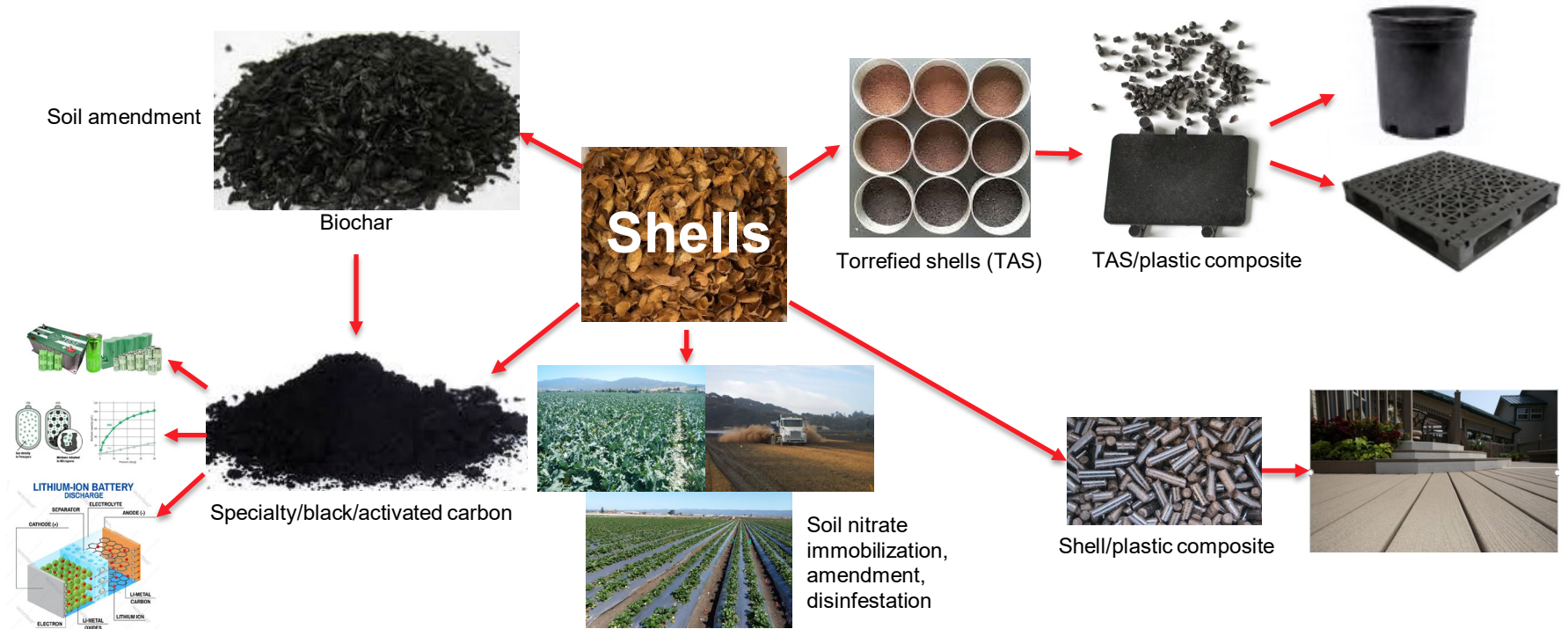
- Bedding/mulching (70%)
- Dairy feed (10%)
- Energy feedstock (10%)
- Soil amendment (10%)



- Volatile matter 72.2%
- High heating values 18.4 MJ/Kg
- Carbon 47.2%
- Ash content 3.8%



# Shells: Reliable Feedstock for High Value Specialty Carbon



*Thank*  
**YOU**





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Thank  
You!

