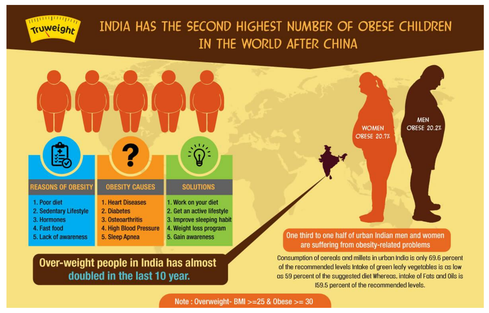
Evaluation of extrudates from sorghum-grape pomace blends by extrusion processing

Sushil K. Singh[1,2], Poonam Singha[2,3] & Madhuresh Dwivedi[1]

[1]*Department of Food Process Engineering, National Institute of Technology, Rourkela, OD, India*
[2]*Department of Agricultural Engineering, South Dakota State University, Brookings, SD, USA*
[3]*Department of Food Science, Cornell University, Ithaca, NY, USA*

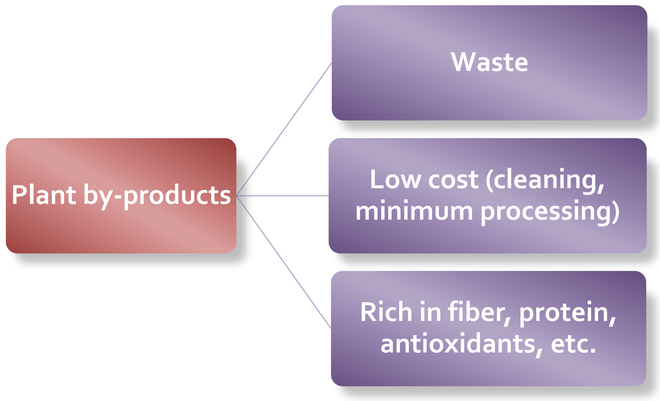
Introduction

- With the growing awareness of the beneficial effects of healthy diet on the quality of life as well as on cost-effectiveness of health care, the food industry is facing the challenge of developing new products with special health enhancing characteristics. To meet this challenge, it must identify new sources of nutraceuticals and other natural and nutritional materials with the desirable functional characteristics.



Solution?
- Whole grains
- Cut intake of sugar, saturated and trans fat
- Include more **protein, fiber and nutrients** in our diet
- Physical activity

- Grape pomace contains up to 75% of **dietary fiber** and is a rich source of **phenolic antioxidants**. Its incorporation in to food will add value to the grape industry.



- Sorghum is a good source of **fiber, protein, iron** and **B vitamins**. Sorghum flour is also surprisingly high in antioxidants like phenolic compounds and anthocyanin, which help reduce inflammation.

- Extrusion is a versatile process with multiple unit operation occurring simultaneously and by altering the processing conditions, screw profile, or die and using different ingredients, a wide variety of products can be processed by the same equipment.

Product Properties:
- Type of extruder and screw designs
- System parameters – torque, MFR, SME, apparent viscosity, die pressure
- Extrusion parameters – temperature, screw speed, feed rate, L/D ratio, screw configuration
- Feed composition – starch, protein, fiber, moisture

Objective

Investigate the the effects of raw material (feed) composition and process conditions on physical and functional properties of extrudates from grape pomace, sorghum and corn starch using a twin-screw extruder

Materials & Methods

- Twin screw extruder
- L:D = 24.5:1
- Screw geometry: length 735 mm, diameter 30 mm
- Extrusion capacity: 5-15 kg/hr

Table 1: Ingredient composition of blends

Feed ingredients	Mass of ingredients (g kg^{-1})				
	Blend 1	Blend 2	Blend 3	Blend 4	Blend 5
Grape pomace	0	37.5	75.0	112.5	150
Sorghum flour	500	463	425	388	350
Corn starch	500	500	500	500	500

Table 2: Independent numerical & categorical variables and their levels

Numerical variables	Symbol	Coded variable levels				
		-2	-1	0	1	2
Grape Pomace (%)	X_1	0	3.75	7.50	11.25	15.0
Moisture content (%wb)	X_2	15.0	17.5	20.0	22.5	25.0
Screw speed (rpm)	X_3	100	138	175	213	250
Temperature (˚C)	X_4	100	115	130	145	160

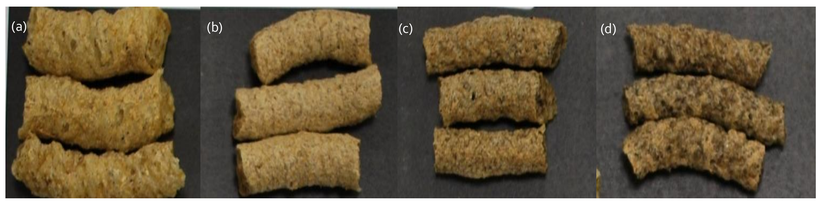


Fig. 1. Sorghum and corn-based extrudates extruded under different processing conditions containing (a) 3.75% grape pomace, (b) 7.5% grape pomace, (c) 11.25% grape pomace, (d) 15% grape pomace

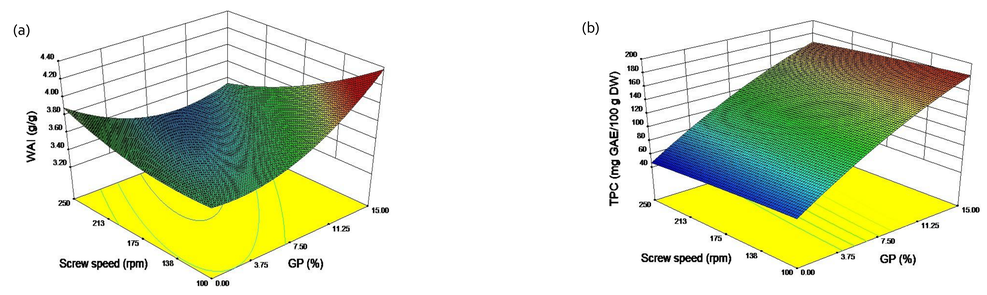


Fig. 2. Response surface graphs illustrating the effects of processing conditions on the water absorption index (WAI) and total phenolic content (TPC) of the extrudates

Significant Outcomes

- Expansion ratio increased with increase in screw speed & decrease in GP.
- WAI increased with increase in GP and screw speed and with decrease in temperature
- Increasing the GP content resulted in a higher TPC and AA in the extrudates.
- Increase in GP content decreased the hardness and increased the brittleness of the extrudates

References

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