Preparing Kava:
Optimizing kavalactone extraction in water

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Background

Kava is normally prepared as an aqueous extract of the macerated root and/or rhizome (stump) by mixing with water and straining the mixture.

In the late 20th century kava popularity increased in Europe. There kava was consumed in tablet form based on a non-aqueous extracts, that were 'dried' to remove the solvent.

The kava-liver controversy in Europe severely reduced demand and price throughout kava growing areas including Hawaii.

A 2003 meeting in Hilo was held to plan the future of kava in Hawaii. Kava farmers, kava product makers, kava leaders and University of Hawaii faculty from CTAHR participated.

It was agreed that Hawaii should emphasize the traditional kava beverage made from Hawaii varieties and educate the public about kava, its culture, uses, and history.

In Honolulu the ʻAwa Development Council formed to educate the public about kava and to organize an annual festival.

The Hawaii and Pacific Islands Kava Festival has been held on or near the UHM campus since 2003.

Hawaii and Pacific Islands Kava Festival

Promoting kava as beverage has several advantages for Hawaii

Hawaii has its own unique varieties and kava history.
Hawaii is a high cost producer and competing with lower cost producers to sell in the dry kava market for extraction is challenging.
Hawaii produced and sold kava for beverage in ready to use forms -fresh, fresh frozen and dried.
Hawaii's revitalized kava culture focused on informal kava circles and kava 'bars'.
Hawaii has over 7 million tourists a year who could first try kava here.
Kava is a beverage for the 21st century; Oahu's commuters would benefit from its stress relieving effects.

Getting the most out of your kava and into to the bowl.

Kavalactones are the principle active ingredients.

Essentially kavalactones are not soluble in water.

Kava beverage is not a solution like tea; rather it is a recalcitrant suspension like oil, vinegar, and spices in salad dressing.

Hand prepared kava beverage removes about 15% of kavalactones in the kava, the remaining 85% is in the press cake. The press cake is trash.

Eight factors affecting efficiency of kavalactone extraction in water

Water to kava ratio
Water temperature
Intensity of maceration in water
Duration of maceration in water
Repetitions of maceration in water
Size of kava pieces
Storage- fresh, fresh frozen, dried
Plant part – root or rhizome

The preparer of kava beverage sets these eight parameters.

Experimental design

Eight factors at 2 levels is $2^8 = 256$ combinations.
We chose to use a two level, quarter fraction design with 16 treatment combinations.

All kava samples were subsampled for Kl content prior to water extraction, dried, extracted with ethyl acetate. Beverage samples were freeze dried and extracted with ethyl acetate. Kl content at start and in final beverage expressed at mg Kl per g dried part, and mg Kl in beverage/g Kl in part.

Kl determined by gas chromatograph with flame ionization detector calibrated on purified samples of the 6 major Kl.

Treatment Variables

8 variables at 2 levels, of 256 combinations we selected 16 to evaluate.

Plant part - root (R) or rhizome /stump (S)
Size of piece before extraction - 10 or 1 mm
Process and Storage – Dried at 40C, store 21C (D)
or Frozen and store at -20 C (F)
Water temperature at start of extraction- 20 or 45C
Water weight total : kava wt. for extraction- 1 or 3
Number of extractions (macerations) - 1 or 3
Duration of maceration (seconds) – 60 or 120 s
Intensity of maceration 18,000 rpm Blender (B) or hand (H)

Size of Variable and 2nd order Interactions Effects

Plant part - 37 - strong effects are noted in red.
Size of piece - 15
Process and Storage - 10
Water temperature at start - 47
Water weight total : kava wt. - 20
Repetitions of macerations - 42
Maceration duration (seconds) of each extraction - 50
Maceration Intensity - 28
Duration of maceration X Temperature - 71
Repetitions of maceration X Time - 38

Least Kl removed 52 mg – R, big piece, frozen, 20C, 1:1 water, 1 extract cycle for 120 sec of hand kneading.
Most Kl removed 542 mg – R, small piece, frozen, 45C water, 1:3 water, 3 maceration cycles, 120 sec maceration.

Searching variable levels for highest removal

8 root and 8 stump samples were extracted and mg Kl removed /g KL in sample using these variable levels:
Root and stump separately
3 repetitions of maceration
3:1 water to kava total dilution
47C water
Maceration duration per repetition 40 s (120 s total)
Maceration in blender at 18,000 rpm.

Average kl removed mg/g in kava
393 mg/g Kl in stump
402 mg/g Kl in root

Impacts of Optimizing Kl removal using the CTAHR method

Taste change – peppery flavor when water above 40 C (104 F)
Taste change – a cooked starch or doughy flavor if dried above 60 C (140 F) or if water above 50C (122F).

Texture change in beverage – kava starch gels if water above 60 C (140F), very difficult to strain beverage.

Blender noise and blender burn out. Our blender is a $300 Vitamix 'Bar Boss' 8.5 amps, with high temperature auto shut off. In operation first half is 18,000 rpm, second half is 36,000 rpm. I wear ear protection.

Using the CTAHR method

If using dry kava powder, add 100 g powder to blender jar, add 1150 ml hot tap water (this includes 400 ml to replace water lost during drying). If using fresh or thawed frozen chopped kava, add 750 ml of hot tap water to blender jar then add 500 g kava.

Close blender jar, blend at highest speed for 1 min. Pour kava into 1 gal. paint strainer bag, pinch bag shut, squeeze liquid from bag into bowl.

Add 750 ml hot tap water to jar, add press cake from bag, close jar, run blender for 1 min, pour into bag, squeeze liquid into same bowl. Repeat- add water, add press cake, blend, and squeeze. Makes 2.2 L (more than half gal.). Dilute with water if too strong.

Questions or Comments?

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