NOTE

Effects on Barley and Malt of Oil Additives to Reduce Dust

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ABSTRACT

Four barley cultivars and four malts from those cultivars were treated with 200 and 400 ppm of mineral or soybean oil. The treatment reduced fine grain dust. Oil treatment had a small effect on barley color. Diastatic power and α-amylase in malt from treated barley were lower than in the controls. The decrease was not significant at the 0.05 level. Treatment of malt had no significant effect on fine-minus-coarse extract difference, wort color, wort protein, diastatic power, or α-amylase.

The effectiveness of oil additives to suppress dust formation and explosiveness during handling of wheat and corn in marketing channels was reviewed by Miller and Pomeranz (1979) and by Lai et al (1981a). Lai et al (1981b) reported no detrimental effects of oil additives (at 200 and 400 ppm levels) on milling and breadmaking properties of wheat. We report here on the effects on malt analytical parameters of spraying barley or malt with 200 or 400 ppm of mineral or soybean oil.

MATERIALS AND METHODS

Barley Cultivars

Samples of barley cultivars included in this study were, Klages and ID78Ab6871, two-rowed barleys; and Morex and ID78Ab9009, six-rowed barleys.

Oil Application

White mineral oil (Witco Chem. Corp., Petrolia, PA) and refined soybean oil (Staley Mfg. Co., Decatur, IL) were applied at levels of 200 and 400 ppm to barley and malt with a syringe. The sprayed barley or malt was tumbled in a barrel at 15 rpm for 10 min.

Malting

The barley samples were cleaned on a Hart-Carter Dockage Tester, and the barley retained on a 5/64" sieve was malted. Lots of 170 g of barley were malted using procedures described by Dickson et al (1968). Briefly, the lots were steeped in water at 16°C to attain a moisture content of 45%. The steeping time required for most samples varied from 30 to 36 hr. Steeped samples were germinated in malting chambers at 16 ± 0.5°C for four days. The final kiln temperature was 85°C.

Analytical Methods

Barleys, malts, and worts were analyzed by the methods of the American Society of Brewing Chemists (1975) except that extract was determined on material obtained by using 25 g of ground malt instead of 50-g samples. Unless stated otherwise, analytical results are expressed on a moisture-free basis. Protein was calculated by multiplying Kjeldahl N by the factor 6.25.

The following determinations were made: barley protein (%), kernel weight (mg), plumpness (% as is basis), Agtron color (arbitrary units), extract (%), fine-minus-coarse grind extract (F–C, %), wort color (arbitrary units), wort nitrogen (%), wort-soluble protein/total protein (%), diastatic power (arbitrary units), and α-amylase (dextrinizing units [DU], 20°C).

All determinations were replicated twice, each for two separately malted samples. Analyses were made on the original grain and on oil-treated samples. Appropriate analytical determinations were made on the oil-treated barleys, the corresponding malts produced from them, and on oil-treated malts. All results were averaged and subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Treatment with mineral oil reduced the amount of barley dust generated in a laboratory test (drop test, C. R. Martin, *personal communication*). The amount of fine dust (g/m^3) in individual samples of the four cultivars was 0.63–6.58 (avg. 2.70) for the untreated barleys, 0.43–3.41 (avg. 1.43) after treatment at the 200 ppm oil level, and 0.18–2.30 (avg. 0.87) at the 400 ppm level. Mineral and soybean oil were equally effective in dust reduction.

As expected, treatment of barleys for dust control was ineffective in reducing dust in the resulting malts following processing. There were no consistent differences in the amounts of fine dust generated in barley and malt, even though they differed widely in moisture content (about 10% in the barleys and 5% in the malts). There were large differences in the amounts of fine dust among the four barley cultivar samples; the average amounts (g/m^3) in four samples of untreated barley were 0.79 in Klages, 5.10 in Morex, 1.76 in 78Ab6871, and 3.14 in 78Ab9009. Additional

TABLE I
Characteristics of Malt Produced From Oil-Treated Barley

Analytical Parameter	Oil Level (ppm) 0	200	400
Barleys			
Barley protein, %	11.13	11.04	11.15
Barley kernel wt., mg	37.2	37.3	37.2
Plump barley, %	79.5	79.4	79.6
Barley color, Agtron	59.4 ab[a]	58.2 bc	57.2 c
Malts			
Malt extract, %	80.0	80.0	79.9
F – C[b] difference, %	1.14	1.06	1.15
Wort color	1.38	1.33	1.32
Wort protein, %	4.75	4.75	4.74
Soluble/total protein, %	42.9	43.3	42.9
Diastatic power	119.3	118.3	116.9
α-Amylase (DU)[c]		36.8	36.4

[a] Within line, means followed by different letters are significantly different (0.05 level of probability).
[b] F – C = Fine-minus-coarse.
[c] DU = Dextrinizing units.

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TABLE II
Characteristics of Oil-Treated Malt

Analytical Parameter	Oil Level (ppm)		
	0	200	400
Malt extract, %	80.0	79.9	80.0
F − C[a] difference, %	1.74	1.53	1.63
Wort color, Agtron	1.38	1.39	1.43
Wort protein, %	4.82	4.81	4.83
Soluble/total protein, %	43.5	43.8	44.0
Diastatic power	118.8	116.2	116.1
α-Amylase (DU)[b]	36.8	36.0	36.1

[a]F−C = Fine-minus-coarse.
[b]DU = Dextrinizing units.

determinations are needed to determine the existence of consistent varietal differences. The presence of unusually large amounts of skin-irritating dust particles in the Australian barley cultivar Clipper was reported by Wrigley et al (1979).

No significant differences in the effects of soybean and mineral oils and no consistent differences in the effects of oil treatment on barley and malt parameters among the cultivars could be established. Consequently, the treatments were evaluated for the combined cultivars and the two oil treatments. Those results are summarized in Table I for oil-treated barleys and in Table II for oil-treated malts.

Treatment of barley affected its color, as determined by the Agtron reflectance method; the effect increased with increase in the level of the oil (Table I). The changes in wort color, diastatic power, and α-amylase were not statistically significant at the 0.05 level (Table I). No significant effects on extract, fine-minus-coarse difference, wort color, protein, and malt diastatic power, or α-amylase were recorded for oil-treated malts (Table II).

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