Applications Note

BEER CONTAMINATION January 1995

Rapid determination of beer contamination using the GPR 12-70 refractometer.

The accidental, or in some cases deliberate contamination of beer after leaving the brewery, can give rise to complaints about product quality by the customer, landlord or manager.

Accidental contamination is usually caused by water, left in pipes after cleaning, finding its way back into the barrel but deliberate contamination can result from the addition of water, beer spillages or non-beers such as lemonade to the good product.

An Index Instruments' customer approached the Company to find if a simple method could be found to quickly identify if the 'whole' beer had been contaminated, and if so by how much. Previously, the method used to identify contamination was distillation which can be time consuming.

If the refractive index of the original beer is known, then measurement of the alleged complaint sample provides a rapid method of detecting a problem and judging its degree.

Three samples were supplied by the customer and these were progressively diluted to obtain a characteristic curve. The contaminated samples were measured on a standard GPR 12-70 refractometer with FC1 hinged sample cover**.**** A LTD-6 Thermocirculator was used to ensure good thermal stabilisation of the instrument and sample. Even small dilutions have a marked effect on the refractive index of the 'whole' beer as shown in the attached tables and graphs. The time taken to measure each sample was a few seconds compared with the many minutes for a distillation.

If the characteristic curve is produced for each beer in the brewery's repertoire, then a good indication of the degree of contamination can quickly be determined. Clearly, the shape of the characteristic curve will be dependent on the contaminant added. In some cases refractive index may even decrease if, for instance, lemonade which contains fairly high levels of dissolved sugar has been added. However, it is clear that measuring the Refractive Index, Brix or Zeiss value of the sample gives a quick, easy method for determining if beer returned as a complaint has been adulterated after leaving the brewery.

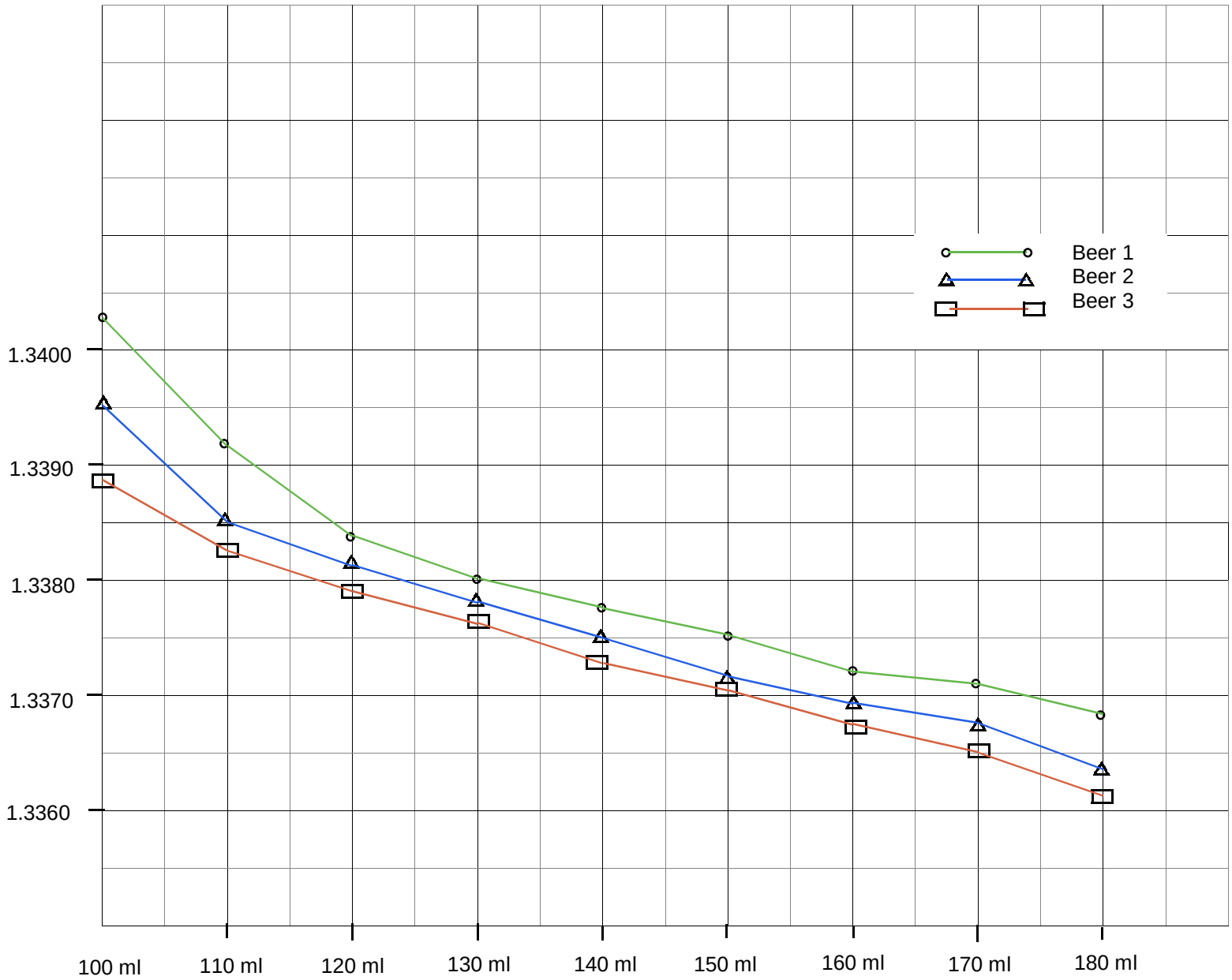
The GPR 12-70 has built-in scales for Refractive Index, Temperature corrected RI, Brix and Temperature correct Brix. The instrument's User Defined Scale can be calibrated in Zeiss units if required. In these trials, the Zeiss values were calculated from conversion tables. The accuracy of the GPR 12-70 is +/- 0.0001 RI, ± 0.1 Brix. If Zeiss is used then the likely accuracy will be ± 1 Zeiss.

****** An alternative instrument to the GPR 12-70 and LTD-6 Thermocirculator would be the PTR 46 which has Peltier cell internal temperature control.

		Refractive Index	Brix	Zeiss
Beer 1 (Bitter)	100 ml	1.3403	5.0	32.0
	110 ml	1.3392	4.3	30.7
	120 ml	1.3384	3.8	28.8
	130 ml	1.3380	3.5	27.8
	140 ml	1.3377	3.3	26.9
	150 ml	1.3375	3.1	26.2
	160 ml	1.3372	2.9	25.2
	170 ml	1.3371	2.9	24.9
	180 ml	1.3368	2.6	24.4
Beer 2 (Bitter)	100 ml	1.3395	4.4	31.4
	110 ml	1.3385	3.8	28.8
	120 ml	1.3381	3.5	27.8
	130 ml	1.3377	3.3	26.9
	140 ml	1.3375	3.1	26.2
	150 ml	1.3371	2.9	25.2
	160 ml	1.3370	2.8	24.9
	170 ml	1.3368	2.6	24.4
	180 ml	1.3364	2.4	23.3
Beer 3 (Dark Mild)	110 ml	1.3389	4.2	29.9
	110 ml	1.3383	3.7	28.3
	120 ml	1.3379	3.4	27.2
	130 ml	1.3376	3.3	26.9
	140 ml	1.3373	3.0	25.7
	150 ml	1.3371	2.9	25.2
	160 ml	1.3368	2.6	24.4
	170 ml	1.3365	2.4	23.3
	180 ml	1.3362	2.2	22.8

Each 100 ml sample of 'whole' beer was successively diluted with 10 ml portions of pure water to make up to the final volume. Each measurement required a sample volume of approx. 0.1 ml.

Zeiss valves has been rounded to the nearest 0.1 Zeiss.


Beer 1
Beer 2
Beer 3
1.3400
1.3390
1.3380
1.3370
1.3360
100 ml
110 ml
120 ml
130 ml
140 ml
150 ml
160 ml
170 ml
180 ml