AN ANTHOLOGY OF FOOD SCIENCE

Volume I.

Introduction to Thermal Processing of Foods

by

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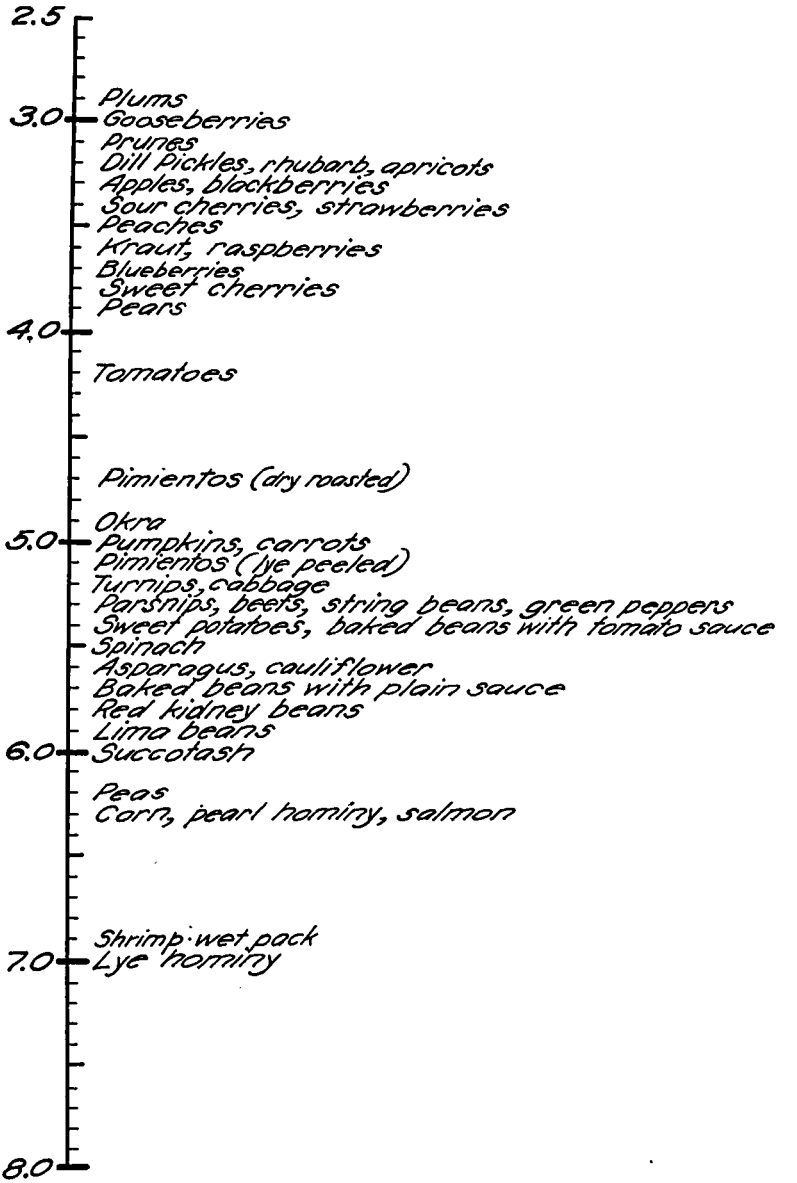

Fig. 1. Acidity of commercial canned foods expressed as pH.

are given, no generalization can be made. It is of interest to note, however, that No. 4500, which had a pH value of 4.68, was peeled by roasting over a flame, while No. 4628, with a pH value of 5.16, was peeled with lye. The latter process, notwithstanding thorough washing that follows, may be expected to decrease the acidity of the product, or, in other words, increase its pH value. The influence of lye is further illustrated in connection with hominy, in which we find a wide variation in pH value.

The results given in the table that follows were obtained by Mr. P. H. Cathcart, of the Research Laboratory of the National Canners Association, with the exception of those credited to Drs. Patten and Mains in the footnotes.

All determinations were made by the hydrogen electrode method.

HYDROGEN ION CONCENTRATION OF CANNED FRUITS

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4228	Apples, Ben Davis	N. Y.	3.28	10	4	212
(1)	Apples	N. Y.	2.88	3	—	——
(1)	Apples	Penn.	3.11	3	—	——
4526	Apricots	Col.	3.21	2½	[2] 5.6	208
4684	Apricots	Calif.	3.22	2½	—	——
4258	Blackberries, 50° syr.	N. Y.	3.56	2	25	212
4534	Blackberries	Ark.	3.23	2	10	212
4535	Blackberries	Ark.	3.38	2	5	212
4261	Cherries, white, unpitted, 40° syr.	N. Y.	3.55	2	15	212
4265	Cherries, red, pitted	Mich.	3.19	2	15	215
4529	Cherries, sour	Col.	3.40	2	7.4	206
4530	Cherries, sweet	Col.	3.66	2	45	206
4531	Cherries, sweet black	Col.	4.12	2	45	206
4537	Cherries, pitted, red	Col.	3.19	10	45	212
4539	Cherries, red, sour pitted	Utah	3.47	10	11.5	203
4540	Cherries, sour pie	Utah	3.35	10	35	203
4542	Cherries, sweet	Utah	3.78	2	[2] 7	203
4543	Cherries, sweet	Utah	3.78	2½	[2] 5.5	203
4557	Cherries	N. Y.	3.16	10	35	212
4207	Cider	Mich.	3.51	3	—	167

[1] Determined by Patten and Mains.
[2] Rotating Cooker.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
(1)	Cider	Mich.	3.13	2	—	—
4256	Gooseberries	N. Y.	2.78	2	15	212
4527	Gooseberries	Col.	3.06	2	1.4	206
4541	Gooseberries	Utah	3.04	10	15	203
4263	Peaches, Hills Chili, 45° syr.	N. Y.	3.50	2	20	212
4658	Peaches, in water	Md.	3.39	3	14	212
4685	Peaches, 25° syr.	Calif.	3.65	2½	—	—
4264	Pears, Bartlett, 30° syr.	N. Y.	3.90	2	15	212
4659	Pears, Kieffer	Md.	3.59	3	—	—
4262	Plums, blue, 50° syr.	N. Y.	2.87	2	6	212
4561	Plums, yellow gage	N. Y.	2.98	2	14	212
4226	Prunes	N. Y.	3.21	3	7	212
4254	Raspberries, Columbian, 20° syr.	N. Y.	3.23	2	25	212
4255	Raspberries, black, 20° syr.	N. Y.	3.65	2	25	212
4257	Raspberries, Cuthbert, 30° syr.	N. Y.	3.69	2	25	212
4266	Raspberries, Cuthbert	Mich.	3.25	2	18	215
4528	Raspberries, black	Col.	3.59	2	[2] 7.3	206
4544	Raspberries, red	Utah	3.30	2	30	180
4554	Raspberries, red	N. Y.	3.23	2	12	212
4259	Strawberries, 30° syr.	N. Y.	3.39	2	25	212
4267	Strawberries	Mich.	3.33	2	18	215
4545	Strawberries	Utah	3.44	2	[2] 4.5	212
4556	Strawberries, 60° syr.	N. Y.	3.11	2	12	212

HYDROGEN ION CONCENTRATION OF CANNED VEGETABLES

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4511	Asparagus, green	Ill.	5.44	([3])	25	240
4555	Asparagus	N. J.	5.65	2	25	230
4206	Beans, red kidney, immature	Mich.	5.83	2	50	240
4214	Beans, red kidney	N. Y.	5.47	1	60	240
4273	Beans, red kidney,	Mich.	5.89	1	110	250
4603	Beans, red kidney	Ohio	5.70	2	110	230
4672	Beans, red kidney	N. Y.	5.21	2	60	240
4614	Beans, red kidney	Ohio	5.64	2	105	232
4186	Beans, Lima, green fancy, No. 1	Ohio	5.94	1	45	240
4187	Beans, Lima, green fancy, No. 3	Ohio	5.79	1	45	240
4188	Beans, Lima, 30% white ex. std. No. 2	Ohio	5.88	2	45	240
4189	Beans, Lima, fresh white	Ohio	5.84	2	45	240
4190	Beans, Lima, dry soaked	Ohio	5.90	2	45	240

[1] Determined by Patten and Mains.
[2] Rotating Cooker.
[3] Tall round can holding 27 oz. net contents.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	PROCESS MIN.	PROCESS DEG.
4249	Beans, wax ref., round pod, No. 2	N. Y.	5.31	2	11	236
4250	Beans, wax ref., round pod, No. 1	N. Y.	5.48	2	11	236
4270	Beans, wax, string	Mich.	5.28	2	36	236
4276	Beans, wax, cut golden	Mich.	5.10	2	28	240
4513	Beans, wax, cut	Col.	5.33	2	—	—
4560	Beans, wax, cut	N. Y.	4.31	2	60	212
4199	Beans, Navy, green	Ohio	5.88	2	50	240
4594	Beans, Refugee, cut	Ore.	5.49	2	55	232
4629	Beans, string, cut	Calif.	5.42	2	35	236
4274	Pork and Beans, plain	Mich.	5.69	1	110	250
4605	Pork and Beans, plain	Ohio	5.71	2	150	232
4212	Pork and Beans, tomato sauce	N. Y.	5.06	1	100	240
4275	Pork and Beans, tomato sauce	Mich.	5.42	2	110	250
4606	Pork and Beans, tomato sauce	Ohio	5.46	2	150	232
4615	Pork and Beans, tomato sauce	Ohio	5.29	2	150	242
4634	Pork and Beans, tomato sauce	Calif.	5.27	2	90	240
4194	Beets, Det. red, fancy, No. 2	Ohio	5.30	1	45	218
4195	Beets, Det. red, ex. std., No. 3	Ohio	5.19	2	45	218
4209	Beets, Det. red, large	Ohio	5.58	2	45	218
4210	Beets, Det. red, cut	Ohio	5.44	3	45	218
4229	Beets, Det. red, over 2 in.	N. Y.	5.00	2	90	212
4230	Beets, Det. red, under 1 in.	N. Y.	4.93	2	90	212
4237	Beets, Det. red, under 1¾ in.	N. Y.	4.95	2	90	212
4238	Beets, Det. red, under 1½ in.	N. Y.	4.95	2	90	212
4552	Beets	N. Y.	5.47	2	40	212
4592	Beets	Ore.	5.36	2½	65	240
4621	Beets	Calif.	5.43	2	60	212½
4622	Beets	Calif.	5.25	2	60	225
4623	Beets	Calif.	5.20	2	60	232
4624	Beets	Calif.	5.01	2	60	240
4683	Cabbage	Wis.	5.19	3	—	——
4675	Cabbage	Calif.	5.33	2½	55	230
4676	Cabbage	Wash.	5.21	2½	60	240
4173	Carrots	Ore.	5.22	2½	75	212
4703	Carrots, sliced	N. Y.	4.87	2	—	——
4591	Carrots	Ore.	4.99	2½	45	235
4635	Carrots	Calif.	4.97	2	45	240
4175	Cauliflower	Ore.	5.65	2½	40	212
4179	Corn	Ill.	6.22	2	75	250
4184	Corn, evergreen, ex. std.	Ohio	6.26	2	75	245

SAMPLE NO.	PRODUCT	SOURCE	pH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4203	Beans, Lima, green fancy, No. 2	Ohio	5.97	1	45	240
4213	Beans, Lima, tiny green	N. Y.	5.67	1	—	——
4239	Beans, Lima, Calif. dry	N. Y.	5.79	2	18	236
4604	Beans, Lima, soaked white.	Ohio	5.97	2	75	230
4630	Beans, Lima, small green.	Calif.	5.34	2	25	236
4215	Beans, ref., 1,000 to 1, fancy No. 1	N. Y.	5.42	1	11	236
4240	Beans, ref., 1,000 to 1, fancy No. 3	N. Y.	5.07	2	11	236
4241	Beans, ref., 1,000 to 1, fancy No. 3	N. Y.	5.25	2	11	236
4242	Beans, ref., 1,000 to 1, ex. std. No. 4	N. Y.	5.22	2	11	236
4243	Beans, ref., 1,000 to 1, ex. std. No. 3	N. Y.	5.33	2	11	236
4594	Beans, ref., cut	Ore.	5.49	2	—	——
4196	Beans, ref., 1,000 to 1, fancy No. 2	Ohio	5.17	1	20	240
4197	Beans, ref., 1,000 to 1, ex. std. No. 4	Ohio	5.18	2	20	240
4198	Beans, ref., 1,000 to 1, std. No. 4	Ohio	5.38	2	20	240
4271	Beans, ref., green	Mich.	5.29	2	36	236
4514	Beans, ref., cut green	Col.	5.26	2	30	240
4538	Beans, ref., cut green.	Col.	5.29	2	18	248
4548	Beans, ref.	Utah	5.35	2	30	240
4572	Beans, ref.	Ohio	5.40	2	30	240
(1)	Beans, ref., No. 3	N. Y.	4.94	2	20	236
4211	Beans, stringless, giant round pod	Mich.	5.06	10	50	240
4512	Beans, stringless, green	Col.	5.11	2	20	240
4547	Beans, stringless, cut	Utah	5.40	2	17	——
4244	Beans, wax ref., round pod, No. 5	N. Y.	5.09	2	11	236
4245	Beans, wax ref., round pod, No. 2	N. Y.	5.06	2	11	236
4246	Beans, wax ref., round pod, No. 4	N. Y.	5.18	2	11	236
4247	Beans, wax ref., round pod, No. 3	N. Y.	5.21	2	11	236
4248	Beans, wax ref., round pod, No. 3	N. Y.	5.12	2	11	236

[1] Determined by Patten and Mains.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4185	Corn, evergreen, std.	Ohio	6.04	2	75	245
4204	Corn	Ohio	6.30	1	75	245
4205	Corn, fancy evergreen	Mich.	6.23	2	75	245
4231	Corn, early evergreen fancy	N. Y.	6.21	2	70	245
4236	Corn, evergreen	N. Y.	6.28	2	70	245
4268	Corn	Mich.	6.26	2	78	250
4515	Corn, Crosby	Minn.	6.29	2	70	244
4516	Corn, Crosby	Minn.	6.29	2	70	242
4517	Corn, Crosby	Minn.	6.27	2	70	250
4518	Corn, Crosby	Minn.	6.37	2	68	242
4519	Corn, Crosby	Minn.	6.36	2	68	242
4521	Corn	Minn.	6.34	2	68	244
4522	Corn	Minn.	6.44	2	68	244
4523	Corn	Minn.	6.41	2	70	250
4524	Corn	Minn.	6.45	2	60	242
——	Corn	Md.	6.08	—	70	250
4565	Corn	Ohio	——	2	70	240
4566	Corn	Ohio	——	2	70	250
4593	Corn	Ore.	6.38	2	110	240
(1)	Corn, Stowell's evergreen	Ind.	6.04	2	70	250
4686	Hominy, lye	Tenn.	7.38	3	—	——
4687	Hominy, lye	Ind.	7.62	3	—	——
4688	Hominy, lye	Tenn.	7.31	3	—	——
4689	Hominy, lye	Ind.	7.48	3	—	——
4690	Hominy, lye	Ind.	6.87	3	—	——
4691	Hominy, lye	Iowa	7.56	2½	—	——
4692	Hominy, lye	Ind.	7.37	3	—	——
4693	Hominy, lye	Ill.	7.26	3	—	——
4694	Hominy, lye	Ind.	7.63	3	—	——
4695	Hominy, lye	Ind.	7.65	3	—	——
4696	Hominy, lye	——	7.93	3	—	——
4601	Hominy, pearl	Ohio	6.34	2	5½ hrs.	212
4625	Hominy, pearl	Calif.	6.31	2½	60	240
4704	Okra	La.	4.91	3	—	——
4176	Parsnips	Ore.	5.27	2	35	212
(1)	Peas, Alaska, No. 3	N. Y.	5.75	2	35	240
4177	Peas, Alaska	Ill.	6.00	2	35	240
4182	Peas, Alaska, fancy, No. 1	Ohio	5.78	1	40	240
4183	Peas, Alaska, fancy, No. 2	Ohio	5.89	1	40	240
4216	Peas, Alaska, No. 3	N. Y.	5.92	1	35	240
4217	Peas, Alaska, No. 2	N. Y.	5.86	1	35	240
4218	Peas, Advancer, fancy, No. 5	N. Y.	5.96	1	35	240

[1] Determined by Patten and Mains.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4219	Peas, Advancer, fancy, No. 4	N. Y.	5.90	1	35	240
4220	Peas, Advancer, No. 3	N. Y.	5.80	1	35	240
4221	Peas, Advancer, fancy, No. 2	N. Y.	5.76	1	35	240
4251	Peas, Alaska, fancy, No. 4	N. Y.	6.04	2	35	240
4252	Peas, Advancer, ext. std., No. 6	N. Y.	5.97	2	35	240
4253	Peas, Alaska, fancy, No. 1	N. Y.	5.82	2	35	240
4269	Peas, Alaska	Mich.	6.09	2	40	240
4297	Peas, Alaska, B4	Ind.	6.15	2	45	240
4299	Peas, Alaska, 4's	Wis.	6.15	2	30	240
4300	Peas, Alaska, 4's	Wis.	6.11	2	35	240
4501	Peas, Alaska, No. 2	Ill.	5.98	2	33	240
4502	Peas, Sweet, No. 2	Ill.	5.98	2	33	240
4503	Peas, Alaska, No. 3	Ill.	6.13	2	30	240
4504	Peas, Sweet, No. 3	Ill.	6.04	2	35	240
4505	Peas, Alaska	Ill.	6.15	2	40	240
4506	Sweet	Ill.	6.11	2	40	240
4507	Peas, Sweet, No. 3	Ill.	6.38	2	30	240
4508	Peas, Alaska	Ill.	6.16	2	30	240
4509	Peas, Alaska	Ill.	6.12	2	33	240
4510	Peas, Sweet	Ill.	5.89	2	35	240
4532	Peas, Alaska	Col.	6.14	2	30	240
4533	Peas, Sweet	Col.	6.13	2	30	240
4546	Peas	Utah	6.23	2	26	240
4549	Peas, Alaska 3's	Utah	6.04	2	27	240
4550	Peas, Alaska, No. 3	Utah	6.20	2	27	240
4553	Peas, Alaska	N. Y.	6.02	2	40	240
4586	Peas	Ohio	6.12	2	40	240
4589	Peas	Ohio	6.00	2	40	240
4636	Peas, Sweet, No. 3	Calif.	6.14	2	45	240
4598	Pickles, dill	Penn.	3.20	2	Not processed	
4599	Pickles, dill	Penn.	3.18	2	Not processed	
4600	Pickles, dill	Wash.	3.14	2½	7	212
4619	Pickles, dill	Calif.	3.38	2½	Not processed	
4620	Pickles, dill, sliced	Calif.	3.49	2½	Not processed	
4678	Pickles, dill	Wash.	3.39	2½	7	212
4627	Peppers, green chili	Calif.	5.32	(1)	38	212
4500	Pimiento	Calif.	4.68	2½	—	——
4628	Pimiento, lye peeled	Calif.	5.16	(2)	38	212
4178	Pumpkin	Ill.	4.99	2	50	250
4180	Pumpkin	Ohio	5.02	3	100	235

[1] Individual size cans.
[2] Can holding 7½ oz.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4181	Pumpkin	Ohio	5.12	3	100	235
4191	Pumpkin	Ohio	4.96	1¾	70	235
4227	Pumpkin, Conn. Field	N. Y.	5.20	3	90	230
4631	Pumpkin	Calif.	5.21	2½	80	240
4674	Pumpkin	Calif.	5.18	2½	75	232
(1)	Pumpkin	Ill.	4.79	2	50	250
4225	Rhubarb	N. Y.	3.16	3	1½	212
4525	Rhubarb	Col.	3.19	2½	5.2	206
4234	Sauerkraut	N. Y.	3.63	2	—	——
4583	Sauerkraut	Ohio	3.60	3	7	212
4584	Sauerkraut	Ohio	3.42	3	11	212
4677	Sauerkraut	Wash.	3.48	2½	13	212
4200	Spinach, fancy	Ohio	5.74	2	70	240
4200	Spinach, fancy	Ohio	5.54	2	70	240
4201	Spinach, ex. std.	Ohio	5.14	2	70	240
4202	Spinach, std.	Ohio	5.22	2	70	240
4224	Spinach	N. Y.	5.48	1	90	235
4551	Spinach	N. Y.	5.47	2	60	232
4632	Spinach	Calif.	5.50	2½	90	240
4633	Spinach	Calif.	5.38	10	90	240
4222	Squash, Boston marrow	N. Y.	5.33	3	90	230
4590	Squash	Ore.	5.04	2½	—	——
4192	Succotash, Ev'g'n corn, fresh beans	Ohio	5.97	2	75	245
4193	Succotash, Ev'g'n corn, dry beans	Ohio	5.98	2	75	245
4272	Succotash	Mich.	6.08	2	70	250
4232	Succotash, E. Ev'g'n corn, dry beans	N. Y.	5.95	2	70	245
4233	Succotash	N. Y.	6.05	2	70	245
4611	Sweet potatoes	Md.	5.29	3	—	——
4626	Sweet potatoes	Calif.	5.38	2½	35	236
4607	Sweet potatoes	Ala.	5.56	2½	50	240
4608	Sweet potatoes	Md.	5.44	3	90	212
4609	Sweet potatoes	Md.	5.33	3	120	212
4610	Sweet potatoes	Md.	5.35	3	160	212
4235	Swiss chard	N. Y.	5.18	2	60	235
4223	Tomatoes, John Baer	N. Y.	4.17	3	45	212
4536	Tomatoes	Ark.	4.44	2	45	——
4563	Tomatoes	Col.	4.20	2	35	206
4564	Tomatoes	Col.	4.21	2	35	206

[1] Determined by Patten and Mains.

SAMPLE NO.	PRODUCT	SOURCE	PH	SIZE OF CAN	—PROCESS— MIN.	DEG.
4573	Tomatoes	Ohio	——	2	35	212
4574	Tomatoes	Ohio	——	2	40	212
4575	Tomatoes	Ohio	——	2	9	214
4577	Tomatoes	Ohio	——	3	10	212
4579	Tomatoes	Ohio	——	3	10	212
4580	Tomatoes	Ohio	——	3	35	212
4581	Tomatoes	Ohio	——	3	38	212
4582	Tomatoes	Ohio	——	3	40	212
4587	Tomatoes	Ohio	4.19	2	10	212
4602	Tomatoes	Ohio	4.23	2	10	212
([1])	Tomatoes	N. J.	4.09	2	35	212
4174	Turnip	Ore.	5.20	2½	—	——

HYDROGEN ION CONCENTRATION OF FISH PRODUCTS

SAMPLE NO.	PRODUCT	SOURCE	PH.	SIZE OF CAN	—PROCESS— MIN.	DEG.
4682	Shrimp, wet pack	Miss.	6.89	1	10	240
4702	Shrimp, wet pack	Miss.	6.96	1	10	240
4673	Salmon, red	Ore.	6.33	([2])	90	240
4697	Salmon, red	Alaska	6.30	([2])	90	240
4698	Salmon, chum	Alaska	6.23	([2])	90	240
4699	Salmon, pink	Alaska	6.16	([2])	90	240
4700	Salmon, med., red	Alaska	6.22	([2])	90	240
4701	Tuna	Calif.	5.98	([3])	—	——

In the main, comment on the various classes of foods is probably unnecessary, but the following observations are made regarding several varieties of fruits and vegetables:

Apples.—The pH value of three samples of apples varied from 2.88 to 3.28. The samples examined were all filled into the can without previous heat treatment so that the cans contained a considerable amount of free liquor. No samples of solid-packed apples thoroughly softened by blanching before being filled into can have thus far been examined in the laboratory.

Blackberries.—Of the three samples of blackberries shown in the table the first, No. 4258, has an appreciably higher pH value than the other two.

[1] Determined by Patten and Mains.
[2] One pound tall can.
[3] Can holding 13 oz.

Cherries.—Four samples of sweet cherries were examined, and their pH value was in all cases higher than the pH value of the sour cherries, and on the average materially higher.

Raspberries.—The pH value of the different samples of raspberries varied from 3.23 to 3.69. The samples included red and black varieties and there appeared to be no difference in the relative pH value of the two classes.

Red Kidney Beans.—With the exception of Nos. 4214 and 4672 there was not a great variation in the pH value of different samples of kidney beans. The pH value of No. 4214 was so different from that of other samples examined about the same time that inquiry was made regarding any peculiarity of the beans and the authenticity of the sample. The packer replied that the beans were grown on neighboring farms and believed to be true red kidney. They were grown in the summer of 1919, which was a bad year for beans, the early fall not permitting them to reach full maturity. He suggested that this might explain the apparent abnormal low pH value. He stated that the season of 1920 was a good one for ripening beans and sent us the sample of beans designated as No. 4672, which, he stated, were of the same variety grown on the same farms and undoubtedly fully mature. Examination of these showed an even lower pH value than that of No. 4214. This lower value is surprising, especially in view of the fact that the process used with the sample in question was lower than that of the other samples of kidney beans.

Lima Beans.—The pH value of lima beans averages lower than that of peas, although some samples of lima beans have a higher pH value than some peas. It is clear, therefore, as far as can be determined by the hydrogen ion concentration, that lima beans would require substantially the same process as peas. Of the samples examined, Nos. 4190 and 4604 were ripe beans soaked before canning. The

other samples were green lima beans of various stages of maturity. So far as can be determined by the samples examined, the pH value of the liquor of lima beans is not influenced by the maturity of the beans; or, at any rate, if the maturity of the beans has such influence, it is within the variation produced by individual samples and the processes at various plants.

String Beans and Wax Beans.—The samples of string beans and wax beans include several varieties of beans commonly used for canning. The majority of the samples were of the variety known as refugee, one thousand to one. Unfortunately, in a number of cases the varieties of the beans were not learned. The variations in pH value appear to be independent of variety. There is also no apparent relation between the maturity of the beans and the pH value.

Pork and Beans.—The pH value of pork and beans depends more on the character of the sauce used than on the kind of beans or the process. Plain sauce, which is usually a solution of sugar, molasses, and salt in water, has a pH value substantially the same as water, which, of course, varies according to its hardness and mineral content. Tomato sauce, on the other hand, has considerable acid, the amount and consequently the pH value varying with the amount of tomato pulp used in its manufacture. This is well illustrated in Figure 6 shown on page 29.

The acidity of even the sauce containing the smallest amount of tomato pulp commercially employed is so much greater than that of plain sauce that there is an appreciable difference between the pH value of beans in plain sauce and beans in tomato sauce. The former have a pH value of about 5.7, and the latter of from 5.0 to 5.5. This difference is much greater in the early stages of processing than in the finished product (see page 29.)

No study was made of the influence of pork on the pH

value of baked beans, but it is believed that it would be without influence and that the pH value of beans without pork would be substantially the same as that of beans with pork.

Beets.—The pH value of the beets examined varied from 4.93 to 5.58. The results thus far obtained disclose no influence of variety or maturity; or, if such influence exists, it is doubtless within the variation of the methods of preparation and processing at different plants.

Corn.—The pH value of the various samples of corn examined varied from 6.04 to 6.45, and this variation does not appear to depend alone on the variety of corn, its maturity, or place of growth and packing. The influence of details of factory technique on the pH value of canned corn is indicated on page 37, where it is pointed out that the slower cooling of the corn that results from stacking while hot has an influence on the pH value of stored corn. The continued cooking that results under these circumstances reduces the pH value, and thus makes it appear that the corn when processed had a lower pH value than was actually the case.

Lye Hominy.—Nos. 4686-4695 inclusive are representative cans of commercial lye hominy, each from a different packer, packed at different times during a period of several years. The oldest, No. 4693, was packed in 1913. In as much as there is a wide variation in the pH value of these samples and as it is probable that the pH of mature corn is materially below 7, it seems that an appreciable amount of lye was not washed out of these samples.

Peas.—The pH value of various samples of peas varied from 5.78 to 6.38. The samples included both Alaska and sweet wrinkled peas at various stages of maturity, grown and packed in different sections of the country and processed for different lengths of time. The wide variations noted are probably caused by a combination of the factors

mentioned. Further study is necessary to determine the effect of these individual factors.

Pumpkin.—In view of the difference in variety, geographical location of plant, and sterilizing process, the variation of the pH value of the samples of pumpkin examined is less than would be expected.

Spinach.—The variation in the pH value of different samples of spinach is greater than would be expected. Nos. 4200, 4201 and 4202 are of special interest. All three were packed at the same plant with the same process, in the same size of can, from the same variety of spinach. Two of them have a pH value much lower than that of other samples examined. The other one, No. 4200, had a pH value of 5.74, which was so different from that of the other samples that a duplicate can was examined and found to have a pH value of 5.54. These variations may be due to difference in treatment during blanching and to the varying extent to which samples were cooled.