

**Table S1.** Spearman's correlation was calculated among physicochemical properties.

	<b>pH</b>	<b>TA</b>	<b>AN</b>	<b>AP</b>	<b>Mo</b>
pH	1				
TA	-0.912**	1			
AN	0.690**	-0.717**	1		
AP	0.254*	-0.176	0	1	
Mo	0.213*	-0.099	0.502**	0.056	1
sample size	87	87	87	87	87

\* Spearman's  $P < 0.05$

\*\* Spearman's  $P < 0.01$

**Table S2.** Relative abundance of the prokaryotes in PMs at the genus level

group	A	B	C	D	E	F
subgroup	acidic group	acidic group	acidic group	Near-neutral group	Near-neutral group	alkaline group
<i>Lactobacillus</i>	76.12	22.86	5.45	1.02	1.76	0.31
<i>Caproiciproducens</i>	1.88	14.26	20.68	23.39	7.46	6.04
<i>Proteiniphilum</i>	0.59	4.33	6.88	6.13	18.47	9.73
<i>Petrimonas</i>	0.42	2.59	6.19	3.49	8.17	7.77
<i>Hydrogenispora</i>	0.32	1.92	5.51	3.32	3.25	7.86
<i>Clostridium_sensu_stricto_12</i>	3.11	3.72	2.28	2.31	2.96	1.27
<i>Sedimentibacter</i>	0.44	2.12	3.17	4.86	3.51	4.21
<i>Aminobacterium</i>	0.11	2.17	4.07	2.50	4.58	2.61
<i>Syntrophomonas</i>	0.29	1.44	2.29	2.28	3.31	3.93
<i>Acinetobacter</i>	4.26	0.70	0.03	0.02	0.01	0.07
<i>Methanoculleus</i>	0.09	0.27	2.78	0.50	0.96	2.27
Others	9.37	27.53	23.67	26.72	19.86	28.83
Unclassified	2.98	16.08	17.00	23.47	25.69	25.06

**Table S3.** Samples grouping and size information.

group	A	B	C	D	E	F
subgroup	acidic group	acidic group	acidic group	near-neutral group	near-neutral group	alkaline group
pH range	4>pH≥3	5>pH≥4	6>pH≥5	7>pH≥6	8>pH≥7	9>pH≥8
sample size	16	31	16	5	4	14

**Table S4.** The topology of co-occurrence networks

	Acidic group	Near-neutral group	Alkaline group
Node	434	113	210
Edge	4727	118	288
Average Weight Distance	15.04	2.03	2.54
Diameter	9	7	10
Average Path Length	3.458	1.722	3.677
Density	0.05	0.02	0.01
Modularity index	0.64	0.94	0.87