XL.—*The Reciprocal Salt Pair* (Na, Ba)–(Cl, NO_3) *in Aqueous Solution at* 20°.

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THE investigation of this system was undertaken with a view to ascertain the best conditions for the preparation of barium nitrate from the chloride by interaction with sodium nitrate. The most important equilibria were investigated by one of us in 1917, and the further investigation of the system was taken up later with the intention of completing the equilibrium data at 20° and of extending the study also to higher temperatures. This extension of the investigation, however, has been rendered unnecessary by the work of Coppadoro (*Gazzetta*, 1912, **42**, 1; 1913, **43**, 138). We have restricted ourselves, therefore, to an examination of the equilibria at 20°.

The following values have been determined for the composition of aqueous solutions in equilibrium with one, two, and three salts, respectively, included in the above reciprocal salt pair.

1. Single salts.

Solid phase.	G. of anhydrous salt in 100 g. of soln.	Solid phase.	G. of anhydrous salt in 100 g. of soln.
NaCl	26·40	$BaCl_2,2H_2O$	26·32
$NaNO_3$	46·77	$Ba(NO_3)_2$	8·41

2. System $NaCl$–$BaCl_2$–H_2O.

Solid phase.	Percentage composition of solutions. NaCl.	$BaCl_2$.	H_2O.
NaCl	25·28	1·65	73·07
NaCl; $BaCl_2,2H_2O$	24·59	3·07	72·34
$BaCl_2,2H_2O$	21·23	4·17	74·60
,,	18·52	6·51	74·97
,,	14·50	10·04	75·46
,,	9·54	14·99	75·47
,,	7·80	16·89	75·31

3. System $NaCl$–$NaNO_3$–H_2O.

Solid phase.	Percentage composition of solutions. NaCl.	$NaNO_3$.	H_2O.
NaCl	18·49	18·62	62·89
,,	17·34	21·30	61·36
NaCl; $NaNO_3$	13·80	30·34	55·86
$NaNO_3$	9·56	34·85	55·58
,,	7·67	37·18	55·15

4. System $BaCl_2$–$Ba(NO_3)_2$–H_2O.

Solid phase.	Percentage composition of solutions. $BaCl_2$.	$Ba(NO_3)_2$.	H_2O.
$BaCl_2,2H_2O$	26·07	1·31	72·62
$BaCl_2,2H_2O$; $Ba(NO_3)_2$	25·09	6·93	67·98
$Ba(NO_3)_2$	20·81	6·54	72·65
,,	12·31	6·72	80·97
,,	7·51	7·17	85·32

5. System $NaNO_3$–$Ba(NO_3)_2$–H_2O.

Solid phase.	Percentage composition of solutions. $NaNO_3$.	$Ba(NO_3)_2$.	H_2O.
$NaNO_3$; $Ba(NO_3)_2$	45·74	1·86	52·40
$Ba(NO_3)_2$	37·07	2·07	60·86
,,	14·59	2·49	82·92
,,	5·61	3·89	90·50

6. Quaternary Solutions.

Solid phase.	Percentage composition of solutions. NaCl.	$NaNO_3$.	$Ba(NO_3)_2$.	$BaCl_2$.	H_2O.
$NaNO_3$; $Ba(NO_3)_2$	6·57	37·82	1·62	—	53·99
NaCl; $Ba(NO_3)_2$	15·79	24·08	0·14	—	59·99
$BaCl_2,2H_2O$; $Ba(NO_3)_2$	2·02	—	6·49	22·66	68·83
NaCl; $Ba(NO_3)_2$; $NaNO_3$	14·23	29·75	0·13	—	55·89
NaCl; $Ba(NO_3)_2$; $BaCl_2,2H_2O$	24·16	0·50	7·14	—	68·20

The last noted solution is incongruently saturated.

For the practical application of the above determinations, the following numbers are of interest :

Initial composition of mixture (g. of anhydrous salt per 1000 g. of water). $NaNO_3$.	$BaCl_2$.	Percentage of salt precipitated as $Ba(NO_3)_2$. $BaCl_2$.	$NaNO_3$.
283	337·8	76·45	74·45
471·8	337·8	92·55	54·06

It will, in general, be advantageous to use a relatively large proportion of sodium nitrate in the initial mixture so as to obtain as complete a utilisation as possible of barium chloride. The mother-liquor containing sodium nitrate can be used, after evaporation and separation of the sodium chloride, for the conversion of a further quantity of barium chloride.

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