Ammonium Sulfate and UAN Solution Blends

Depending on the supply of ammonium thiosulfate (ATS, 12-0-0-26S) at times and the purchase price differential between ammonium sulfate and ATS, there are sometimes inquiries made about substituting ammonium sulfate for ATS in blending with UAN solution. Ammonium thiosulfate is a preferred source of sulfur in clear solution fertilizers because it allows for much higher nutrient analysis in finished blends than ammonium sulfate. Ammonium sulfate (i.e. 8-0-0-9S solution and 21-0-0-0-24S dry) has not been used much in solution fertilizers in the past because of the lower grades that are possible – especially if potassium chloride is included in the blend.

It is possible to make an 8.7-0-0-10S solution that has a salt-out temperature of about 32°F. However, the common grade of ammonium sulfate solution found in the market is 8-0-0-9S and is commonly used as a water conditioner for herbicide applications. Generally, 32% UAN solution and ammonium sulfate solution are compatible in any proportion. Table 1 provides information on various 8.7-0-0-10S and 32% UAN solutions that have a salt-out temperature of about 32°F. If 28% UAN and/or 8-0-0-9S solution is used, the resulting blends will have a salt-out temperature of less than 32°F.

Table 2 shows several blends made from dry ammonium sulfate (21-0-0-24S), 32% UAN solution and water. For those with limited experience in formulating liquid fertilizers, keep in mind that dissolving ammonium sulfate to produce these blends is different than adding ammonium sulfate to your glyphosate herbicide mixes. Efficiently solubilizing dry ammonium sulfate in UAN solution and water requires adequate agitation, water/UAN temperature of 50-60°F or greater and adequate equipment.

Tables 3 contains several properties of various ammonium sulfate solution grades while Table 4 details the negative heats of solution of ammonium sulfate, urea, ammonium nitrate and potassium chloride when dissolved in water. The greater the negative heat of solution and the greater the heat requirement to dissolve the various salts in water.

Dale F. Leikam
Fluid Fertilizer Foundation

Table 1. Satisfactory Grades Using UAN and Ammonium Sulfate Solutions
(32% UAN, 8.7-0-0-10S Amm. Sulfate Solution – 32° F Salt-out)

	Ammonium	Soulution Grade	
32% UAN	Sulfate Solution	N	S
- - - - *wt % of final solution* - - - -		- - - - % - - - -	
90	10	29.7	1.0
80	20	27.3	2.0
70	30	25.0	3.0
60	40	22.7	4.0
50	50	20.4	5.0
40	60	18.0	6.0
30	70	15.7	7.0
20	80	13.4	8.0
10	90	11.0	9.0

Table 2. Satisfactory Grades Using UAN Solution and Ammonium Sulfate

(32% UAN, 21-0-0-24S Amm. Sulfate -- 32° F Salt-out)

32% UAN	Ammonium Sulfate	% Water	Soulution Grade N	Soulution Grade S
- - - - wt % of final solution - - - -			- - - - % - - - -	
90	6.0	4.0	30.1	1.4
80	10.0	10.0	27.7	2.4
70	14.0	16.0	25.3	3.4
60	17.0	23.0	22.8	4.1
50	21.5	28.5	20.5	5.2
40	25.0	35.0	18.1	6.0
30	29.0	41.0	15.7	7.0
20	33.0	47.0	13.3	7.9
10	37.0	53.0	11.0	8.9
0	41.0	59.0	8.6	9.8

Table 3. Properties of Ammonium Sulfate Solutions

N	S	Ammonium Sulfate	Water	Salt-out Temperature	Product Density
- - - - - - wt % - - - - - - -				° F	lbs/gal
7.0	8.0	33.0	67.0	9	9.91
7.5	8.5	35.4	64.6	4	10.03
8.0	9.1	37.7	62.3	3	10.13
8.5	9.7	40.1	59.9	5	10.25
8.7	10.0	41.3	58.7	32	10.3
9.0	10.2	42.4	57.6	56	10.35
9.5	10.8	44.8	55.2	104	10.45
10.0	11.4	47.2	52.8	151	10.57

Source: NFDC-TVA

Table 4. Heats of Solution (negative) Of Several N Products In Water at 77 °F

Weight %	Urea	Ammonium Nitrate	Ammonium Sulfate	Potassium Chloride
	- - - - - - BTU per lb of material - - - - - -			
5	107.5	134.5	25.5	100
10	105.5	129.5	24.0	97.3
15	103.5	124.6	23.0	94.2
20	101.5	119.8	22.5	91.4
25	99.6	115.3	22.1	88.8
30	97.8	110.8	21.9	--
35	96.1	106.6	21.6	--
40	94.3	102.5	21.0	--

Source: NFDC-TVA