Properties of Simulants Used to Evaluate Air Cleaning Systems

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NUCON International, Inc.

FIGURE 1

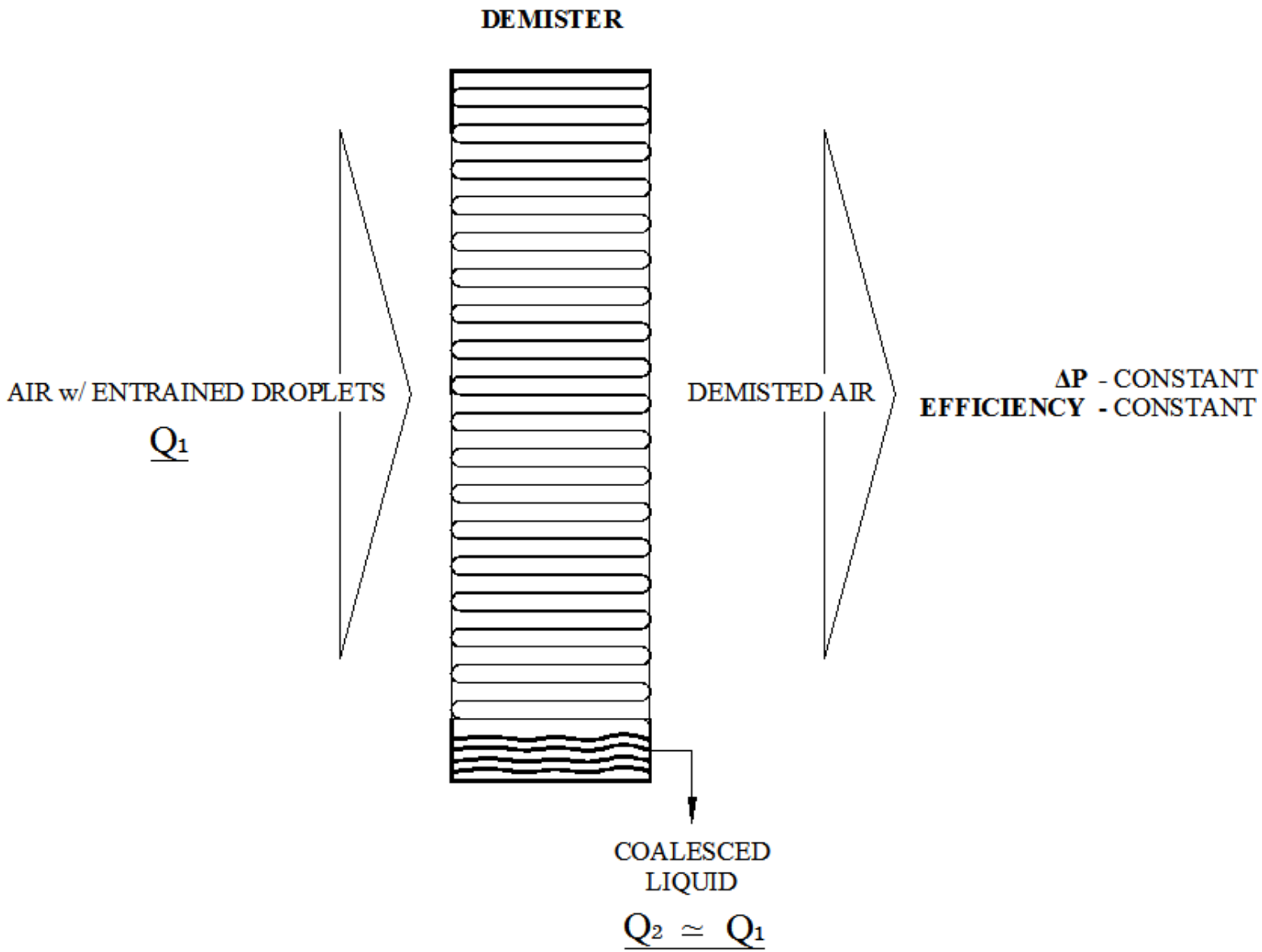

DEMISTER
AIR w/ ENTRAINED DROPLETS
Q_1
DEMISTED AIR
ΔP - CONSTANT
EFFICIENCY - CONSTANT
COALESCED
LIQUID
$Q_2 \simeq Q_1$

FIGURE 2

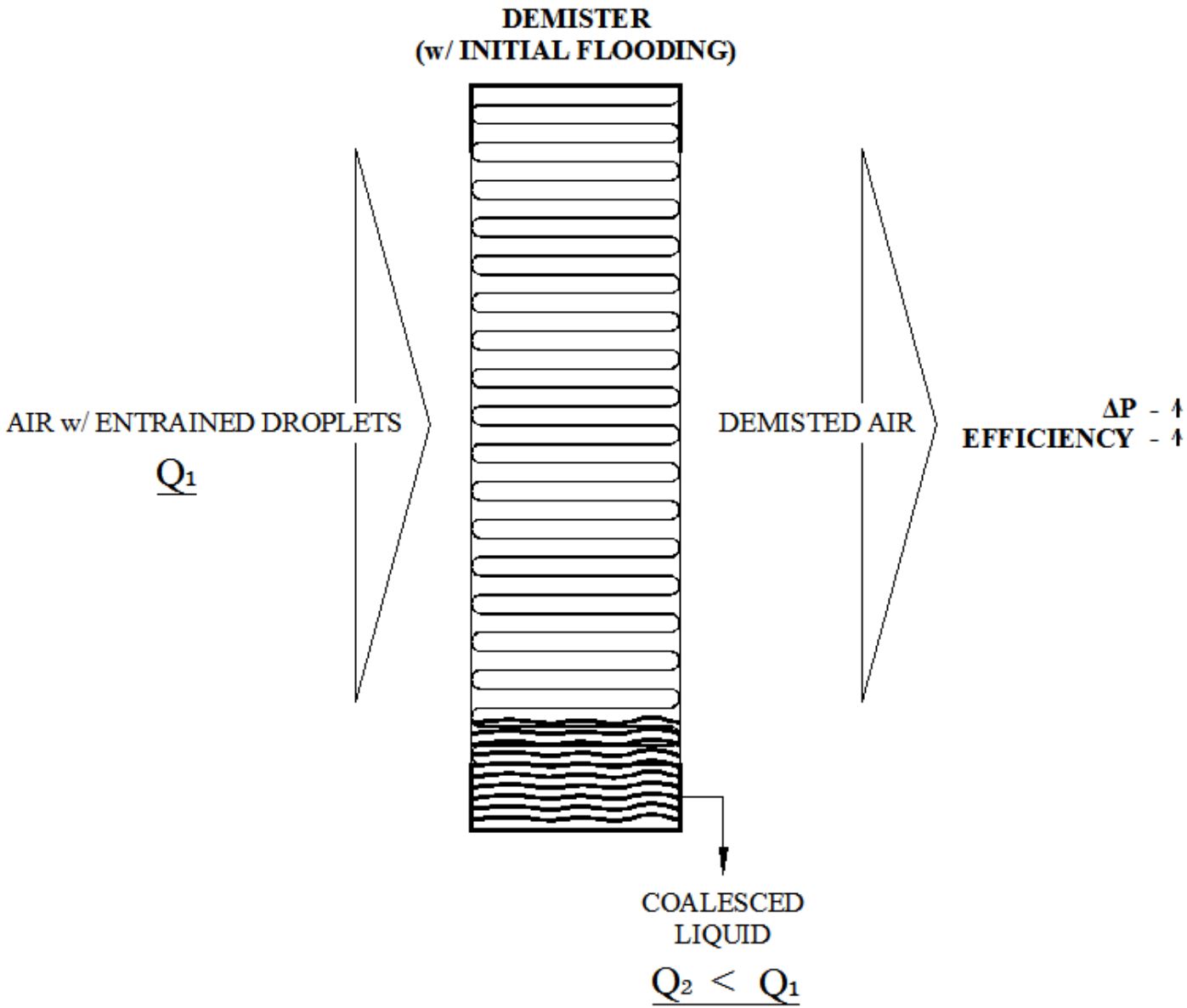
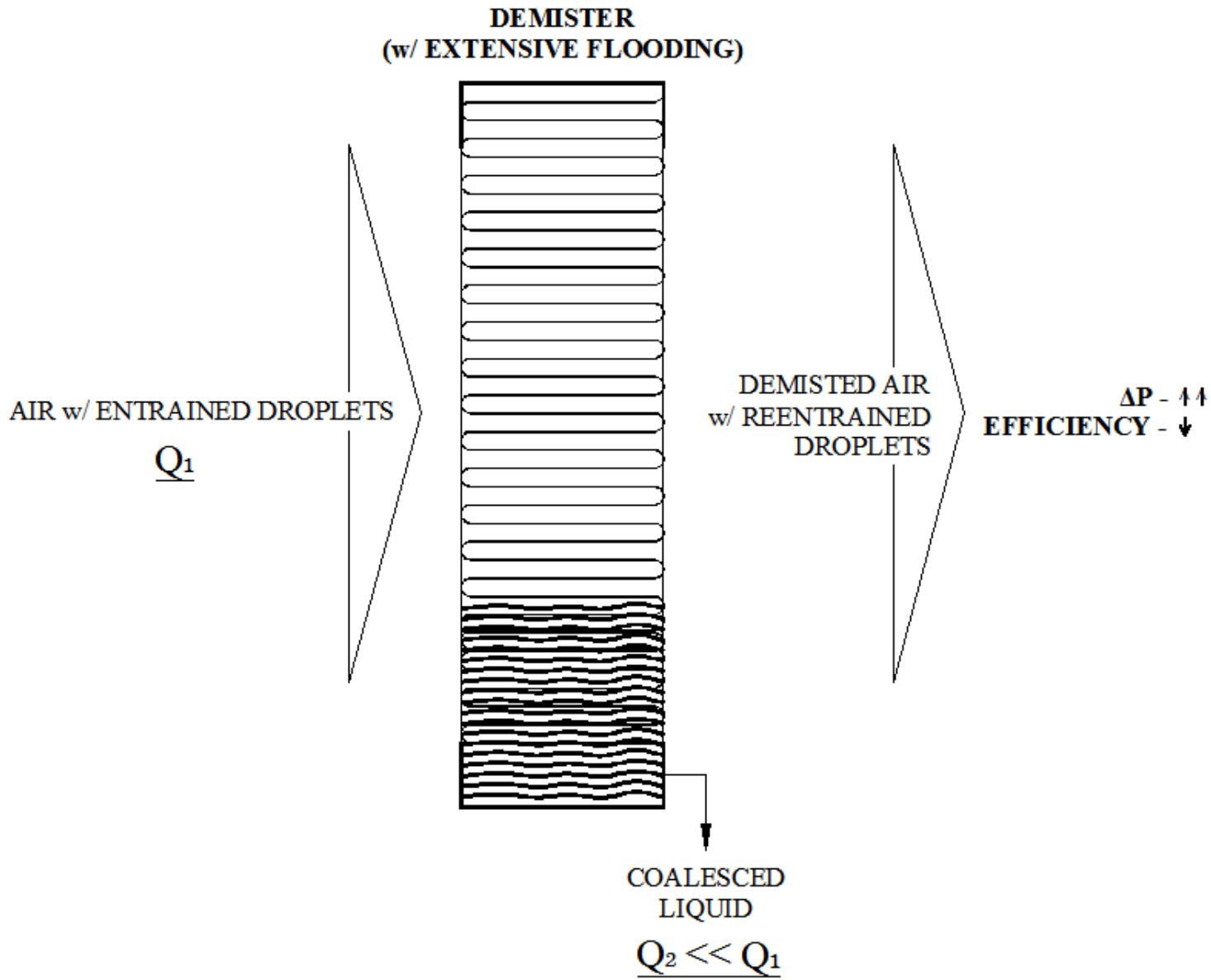

DEMISTER
(w/ INITIAL FLOODING)
AIR w/ ENTRAINED DROPLETS
Q_1
DEMISTED AIR
ΔP -
EFFICIENCY -
COALESCED
LIQUID
$Q_2 < Q_1$

FIGURE 3


DEMISTER
(w/ EXTENSIVE FLOODING)
AIR w/ ENTRAINED DROPLETS
Q_1
DEMISTED AIR
w/ REENTRAINED
DROPLETS
ΔP - ↑↑
EFFICIENCY - ↓
COALESCED
LIQUID
$Q_2 << Q_1$

Moisture Separator Efficiency

- Void fraction in the packed bed.
- Fiber diameter in the packed bed (indirectly, the surface area of the fiber).
- Packing density of the fibers in the bed.
- Superficial gas velocity through the packed bed.

Waste Processing Liquid Streams:

- Liquids containing large amounts (near saturation) of dissolved solids with minimal insoluble particulate content.
- Liquids which act as carriers for insoluble solids.
- Liquids containing large amounts of dissolved solids with a small amount of insoluble material.

Table 1: Comparison of Surface Areas for Typical Carbon Black Materials

Material	Surface Area m2/g	
Cabot Black Pearl	138	(a)
Columbian Raven 1000	92	(a)
Columbian Raven 1040	86	(a)
Columbian Raven M (880)	78	(a)
Cancarb Thermax N991	9	(b)

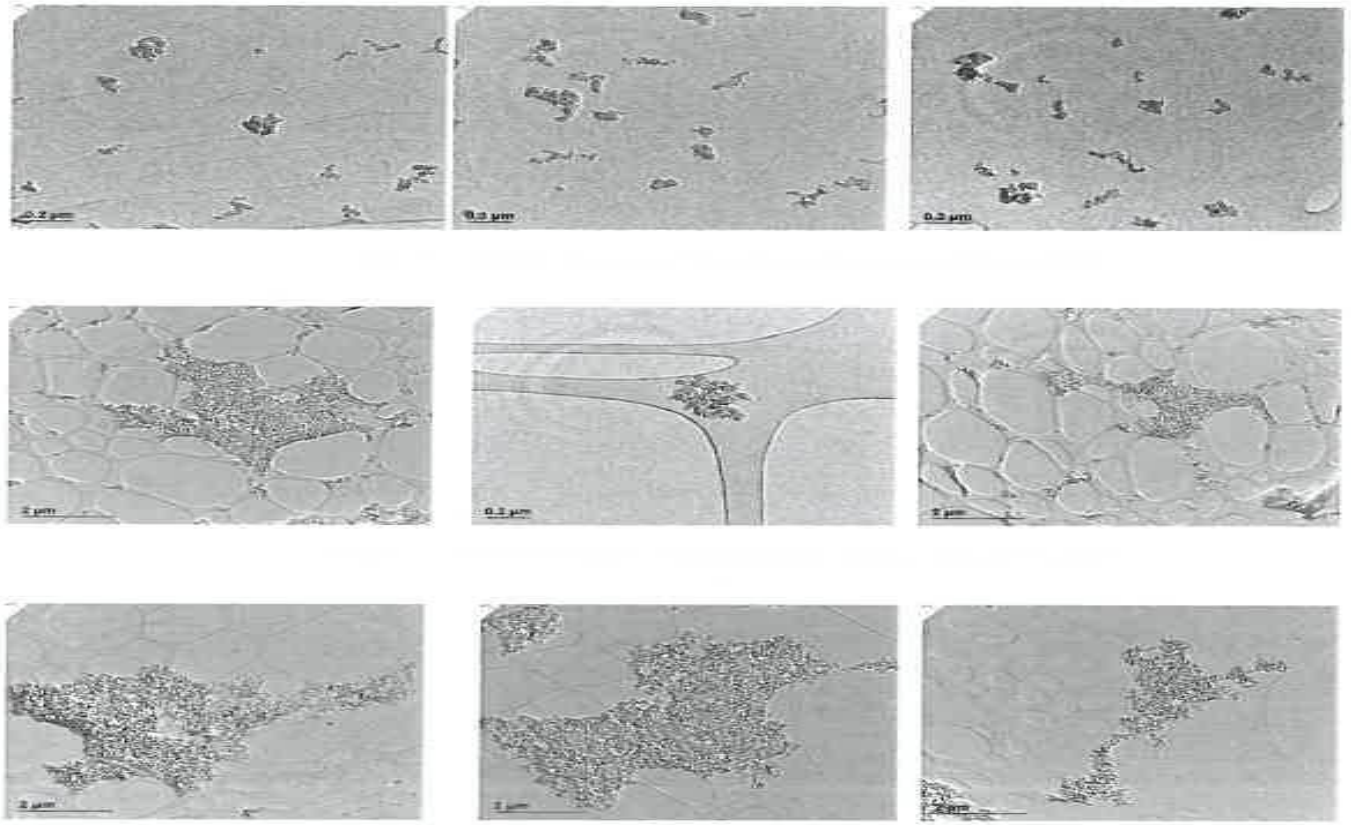
(a) From ORNL/TM-2005/548
(b) NUCON International, Inc. measurement

Typical Properties of Specialty Carbon Blacks

Specific Carbon Black	NSA Surface Area (m^2/g)	STSA Surface Area (m^2/g)
Raven 7000	575	300
Raven 5000 Ultra II	583	350
Raven 3500	375	212
Raven 2500 Ultra	270	206
Raven 2300 Ultra	190	170
Raven 1255	122	119
Raven 1200	106	104
Raven 1170	107	101
Raven 1080 Ultra	79	77
Raven 1040	90	86
Raven 510 Ultra	38	38

NOTE: Data adapted from Birla Carbons technical data sheets for specialty carbon black products

Figure 6: STEM Images of the Aggregation and Agglomeration Behavior of Different Carbon Blacks in a Solvent.



NOTE: Differences in the aggregation and agglomeration of different carbon blacks in any given solvent system are due to differences in the surface chemistry of the specific carbon black.

Figure 7: High resolution TEM image of a specific carbon black (Black Pearls L)

Table 2: Comparison of Actual Waste Surface Areas and Proposed Simulants

Material	Surface Area m2/g	Source
Hanford Waste Gr 1	94	WPT-RPT-166
Hanford Waste Gr.2	46	WPT-RPT-166
Hanford Waste Gr. 3	4.8	WPT-RPT-167
Hanford Waste Gr. 4	2.8	WPT-RPT-167
Hanford WasteGr.8	71	WPT-RPT-170
Carbon Black (Cancarb Thermax N991)	9.4	NUCON
Aluminum hydroxide	2.2	NUCON
Arizona Road Dust	5.6	NUCON

Figure 4

Water Vapor Adsorption

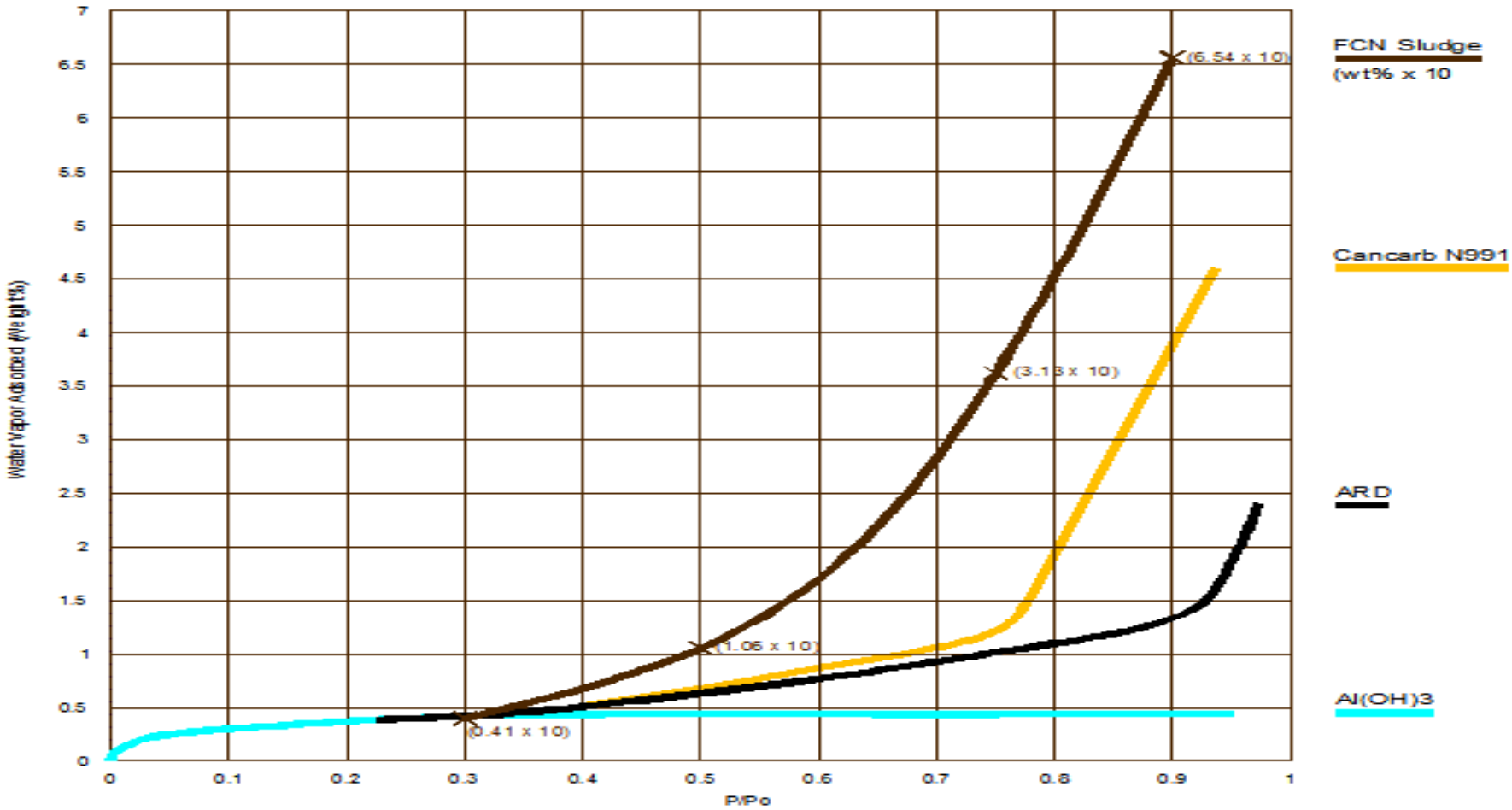
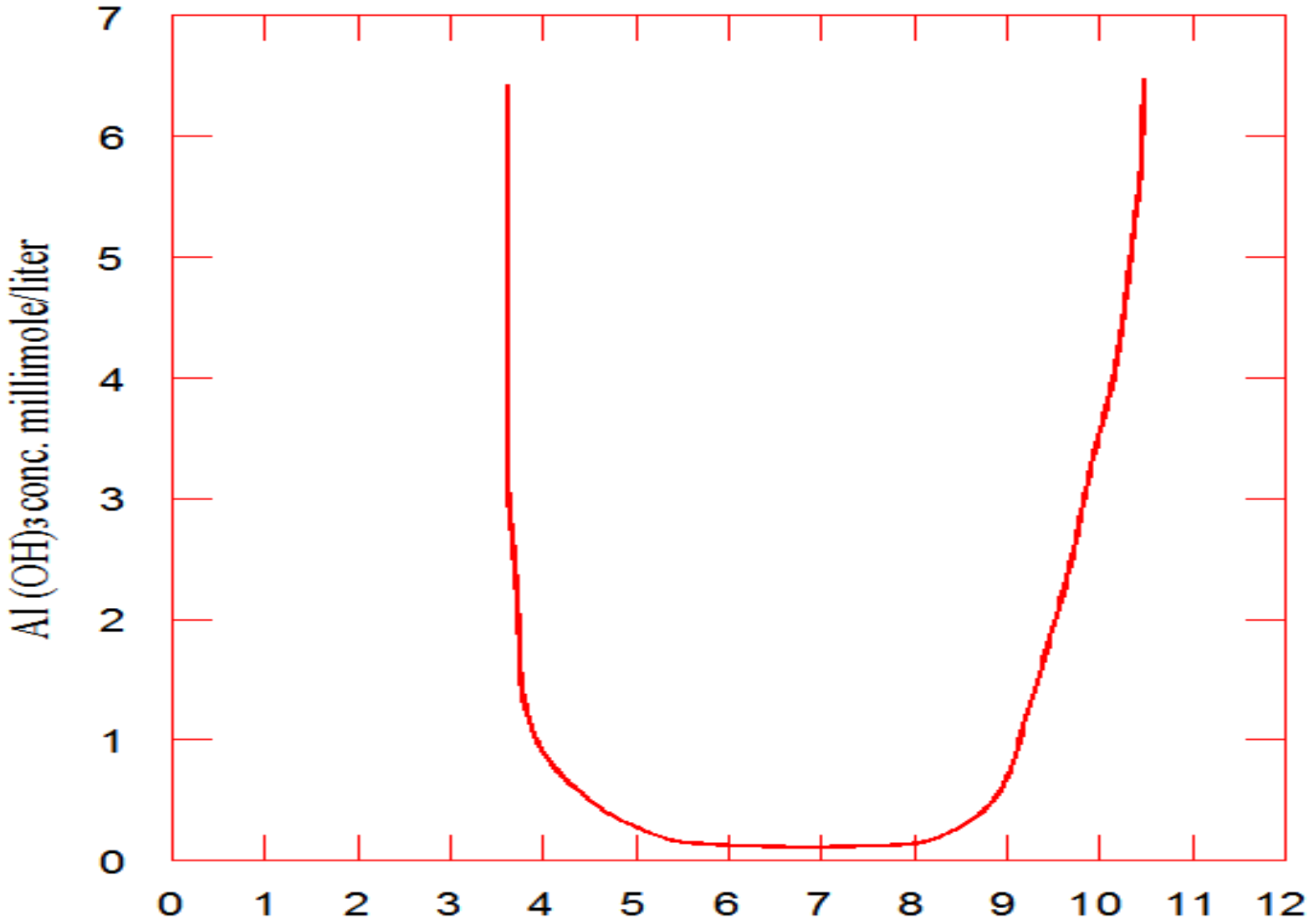
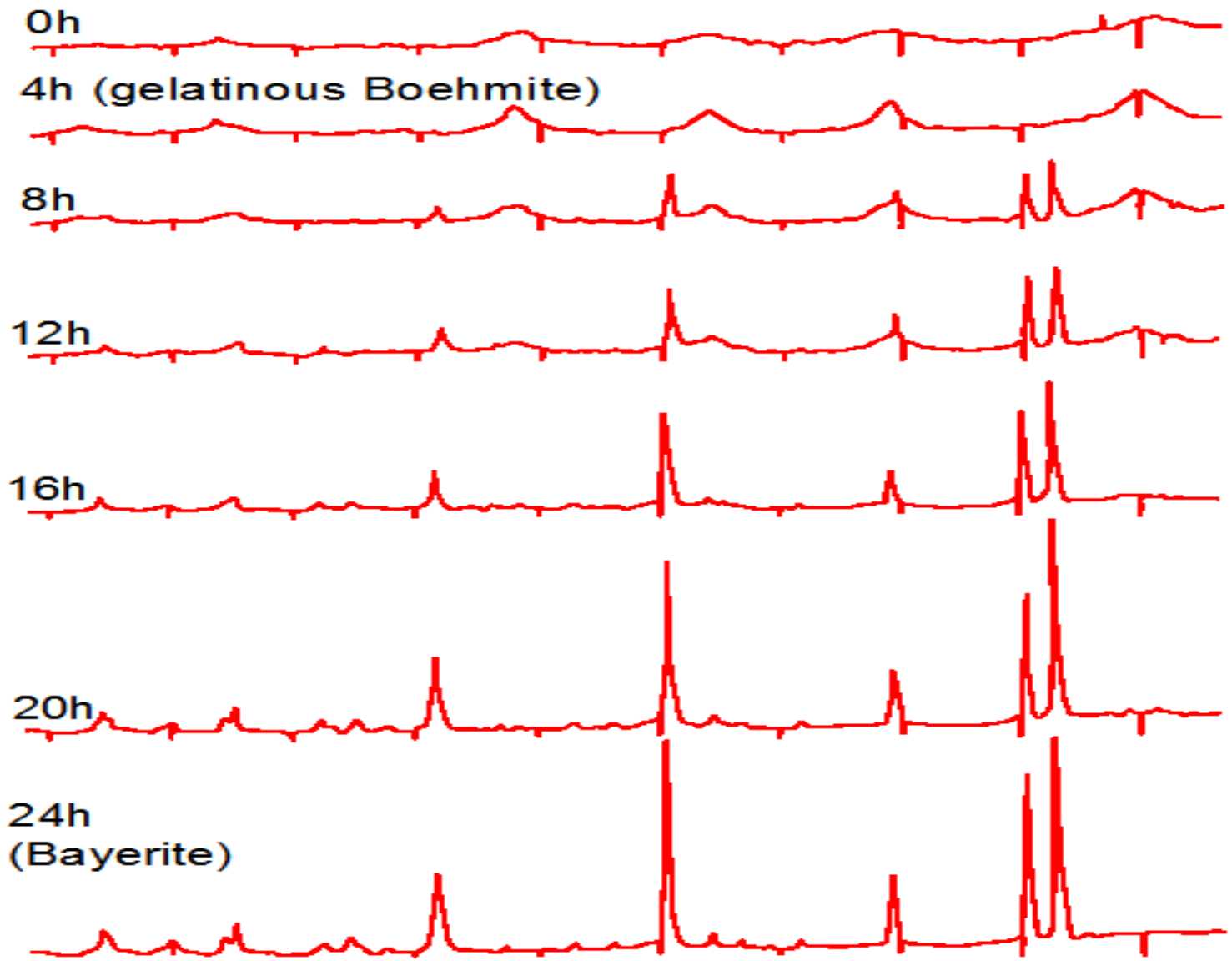


Figure 5



Solubility of Al (OH)3 as a Function of pH
(schematic)
(Wefers & Misra)

Figure 6



Aging of Aluminum Hydroxide Gel,
pH 9, 300K, X-Ray Patterns
(Wefers & Misra)