



Lightweight Aggregate Concrete Blended with Rice Husk Ash and Para Rubber Wood Fly Ash

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Introduction

In Thailand, several tonnes of agro-industry wastes such as oil palm ash and para rubber wood ash were also occurred annually and their disposal causes pollutions of environments.



Si-rich waste
Ca-rich waste



Introduction

Si and Ca-rich wastes are classified as non-hazardous waste

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Reduction
of its volume is very difficult and becomes a problem

Recycling
of these wastes have attracted a lot of attention

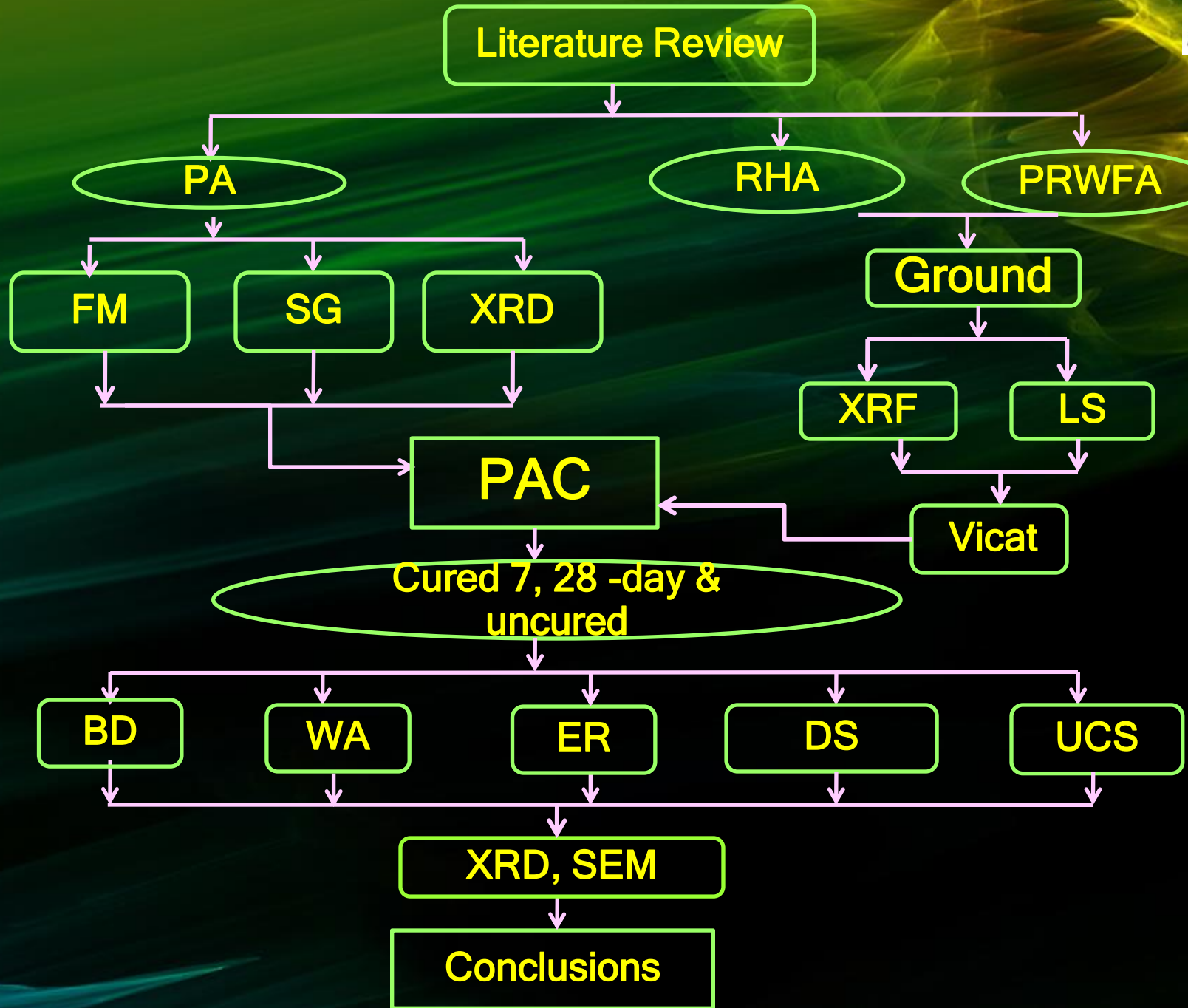


Purpose of Study

To explore the effects of binary and ternary mixtures of RHA and PRWFA on some fresh and hardened PAC properties.



Experimental Procedure



Chemical composition and physical properties of materials used



Compositions (%)	OPC	PA	RHA	PRWFA
SiO ₂	21.2	60.70	87.48	2.57
Al ₂ O ₃	5.22	18.36	-	0.53
Fe ₂ O ₃	3.08	4.61	0.11	0.56
CaO	64.73	5.09	0.70	41.19
MgO	1.04	1.07	-	4.52
K ₂ O	0.42	2.92	1.65	16.11
Na ₂ O	-	0.67	-	-
P ₂ O ₅	-	-	0.72	3.06
SO ₃	2.01	-	0.22	5.54
MnO ₂	-	-	0.32	1.36
LOI	1.45	6.47	8.34	23.28
Specific gravity	3.15	0.60	2.05	2.15
Specific surface area-SSA (m ² /g)	1.63	-	33.13	9.23
Pore porosity (m ² /g)	0	-	30.66	17.72

Physical properties of river sand and pumice aggregate used

Physical Properties	NS	PA
Loose dry bulk density (kg/m ³)	1,485	389
Compact dry bulk density (kg/m ³)	1,587	424
Specific gravity	2.51	0.60
Water absorption 24 h (%)	1.48	56.69
Fineness modulus	3.12	6.26



Ingradient of the PAC batches (kg/m³)

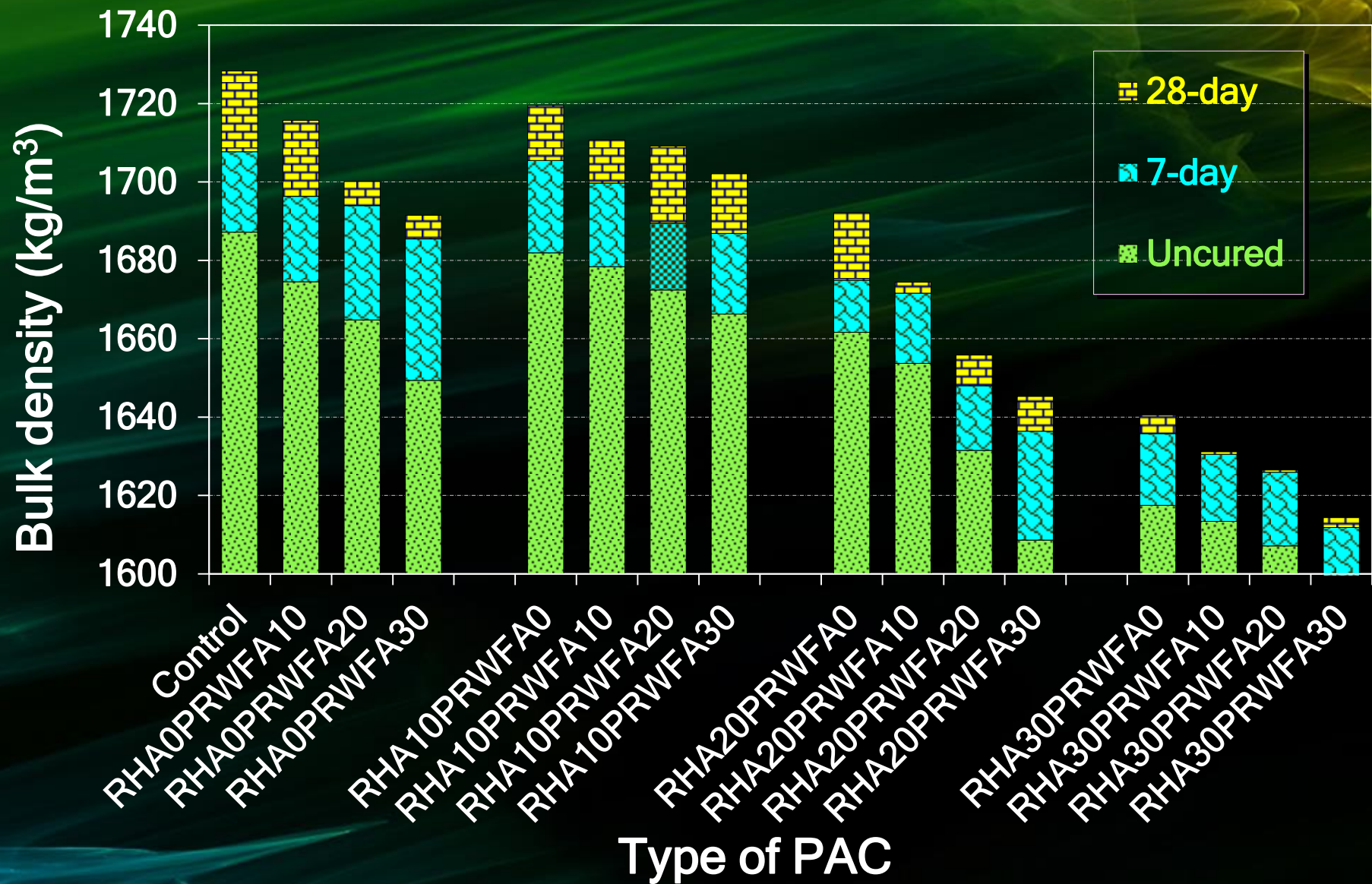
Batch	OPC	RHA	PRWFA
Control	390	0	0
PRWFA10	350	0	40
PRWFA20	310	0	80
PRWFA30	270	0	120
RHA10	350	40	0
RHA10PRWFA10	310	40	40
RHA10PRWFA20	270	40	80
RHA10PRWFA30	230	40	120
RHA20	310	80	0
RHA20PRWFA10	270	80	40
RHA20PRWFA20	230	80	80
RHA20PRWFA30	190	80	120
RHA30	270	120	0
RHA30PRWFA10	230	120	40
RHA30PRWFA20	190	120	80
RHA30PRWFA30	150	120	120

Paste and fresh concrete of PAC

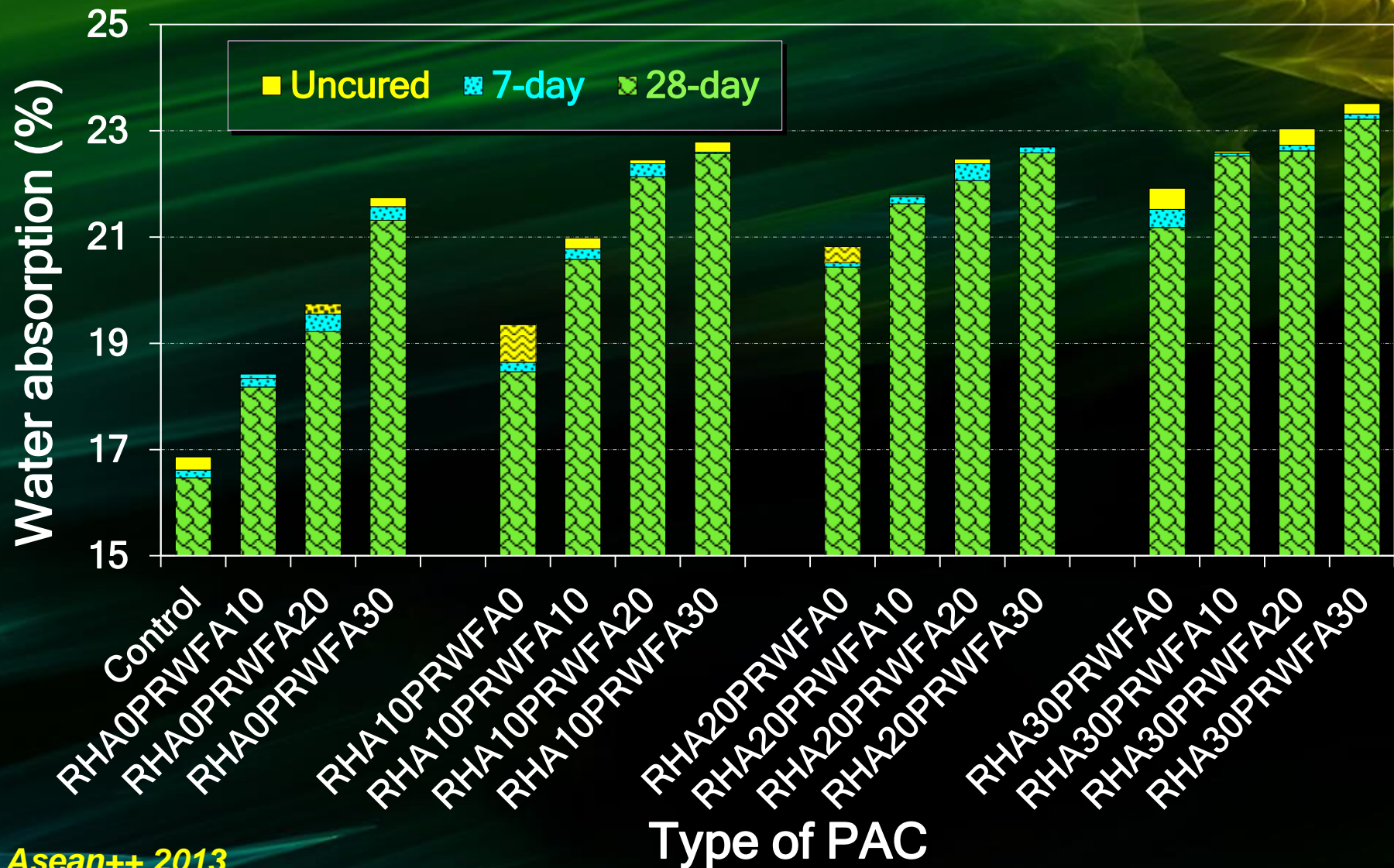


Batch	Setting time (min)		Slump (cm)
	Initial	Final	
Control	310	355	9.5
PRWFA10	250	310	7.0
PRWFA20	170	215	4.0
PRWFA30	120	155	1.0
RHA10	270	315	5.0
RHA10PRWFA10	205	245	3.0
RHA10PRWFA20	160	195	1.0
RHA10PRWFA30	80	105	0.0
RHA20	240	280	2.5
RHA20PRWFA10	190	215	1.0
RHA20PRWFA20	25	60	0.0
RHA20PRWFA30	0	20	0.0
RHA30	20	55	2.5
RHA30PRWFA10	0	35	1.0
RHA30PRWFA20	0	0	0.0
RHA30PRWFA30	0	0	0.0

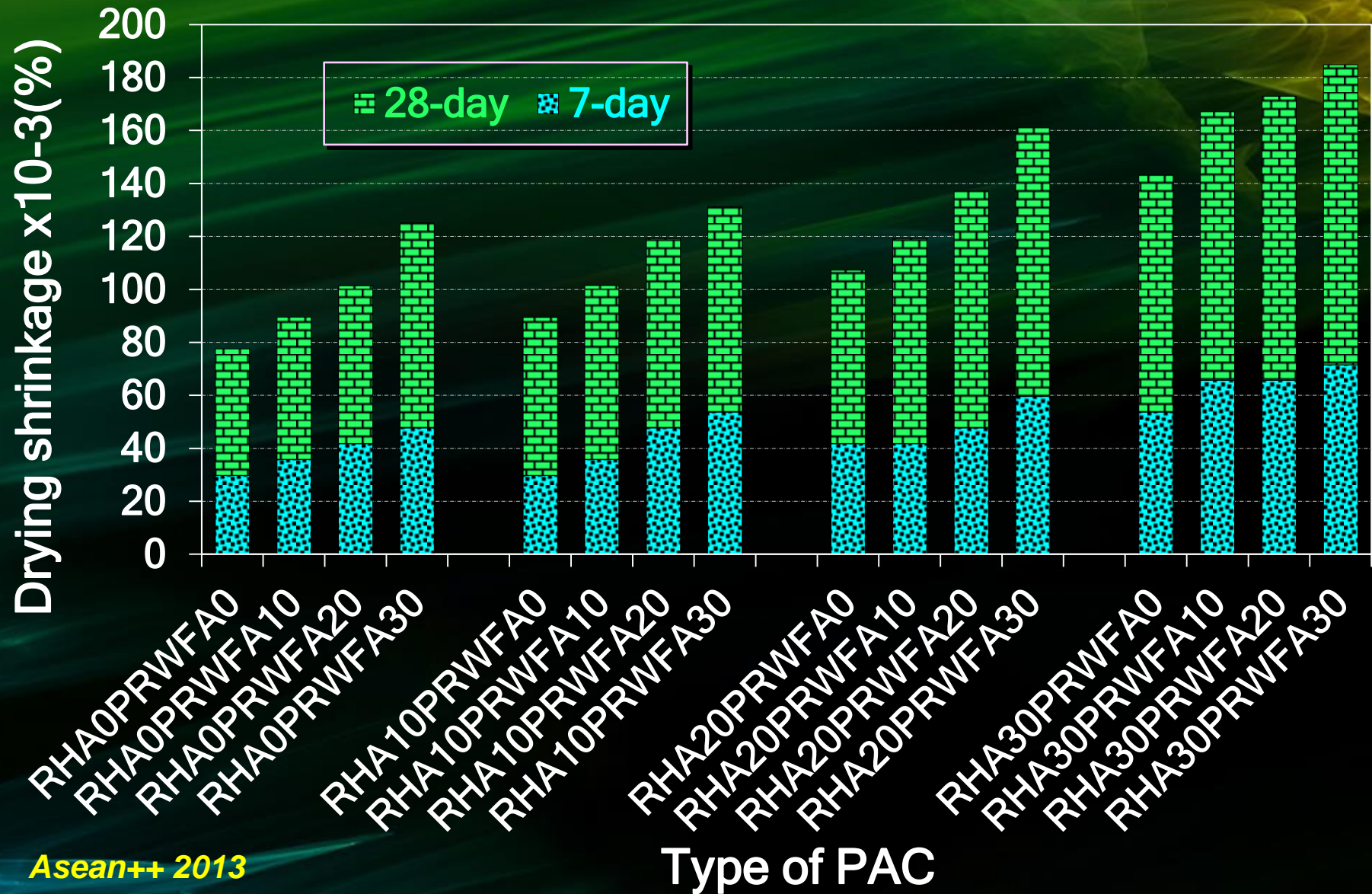
Bulk density of binary and ternary mixtures of PAC



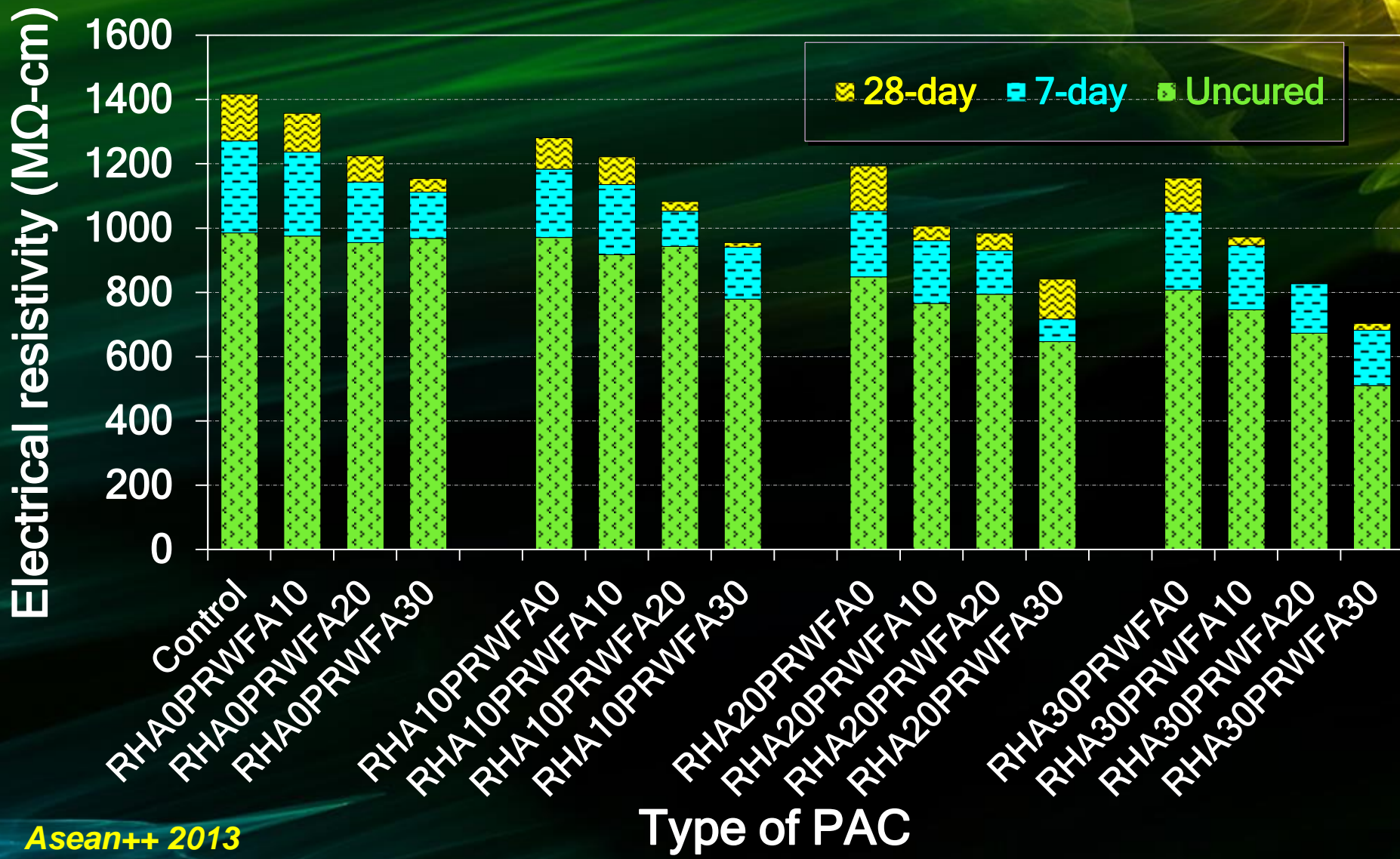
Water absorption of binary and ternary mixtures of PAC



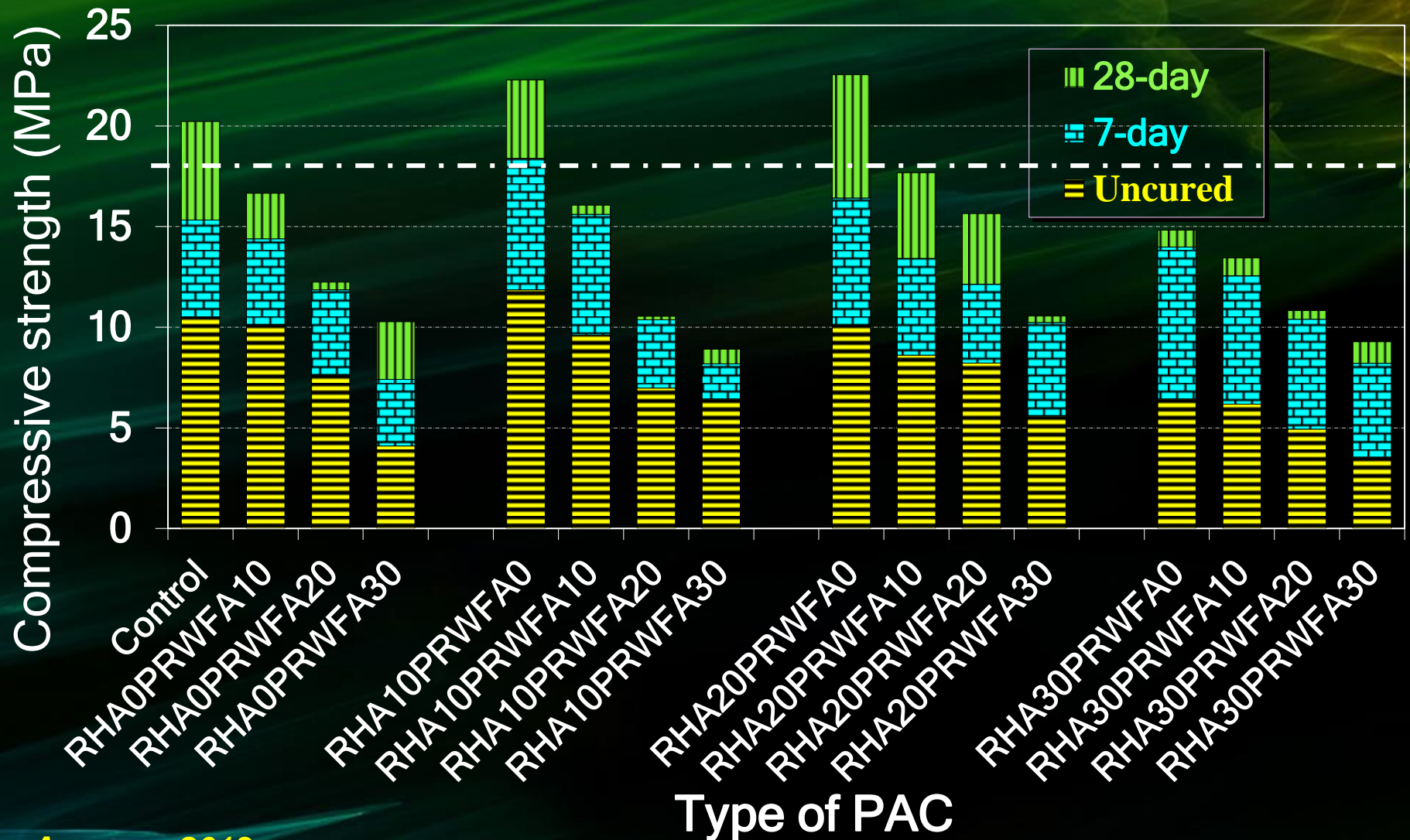
Drying shrinkage of binary and ternary mixtures of PAC

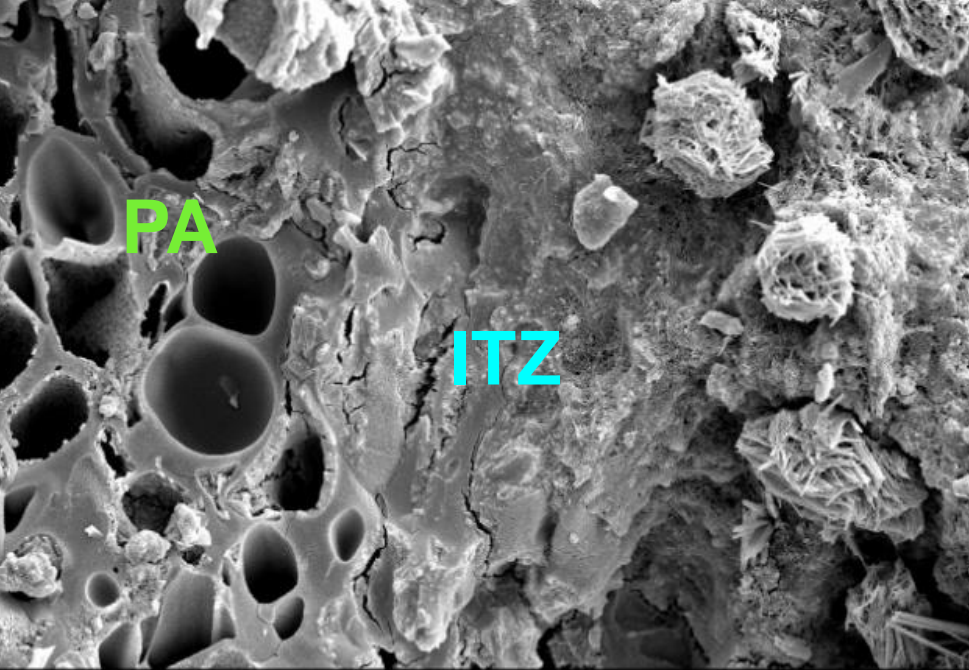


Electrical resistivity of binary and ternary mixtures of PAC



Compressive strength of binary and ternary mixtures of PAC





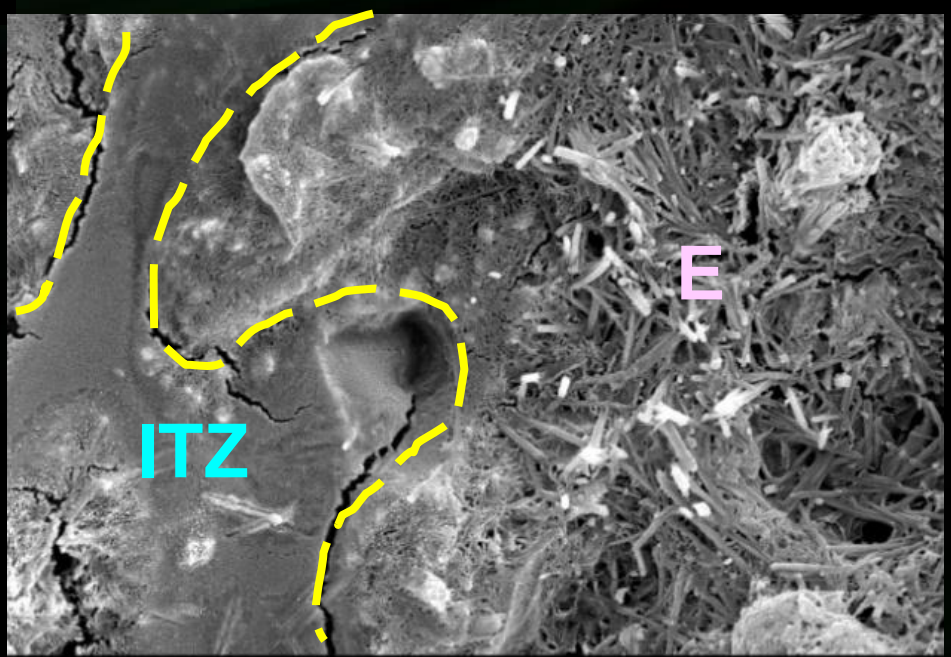
SEM micrograph of 20RHA10PRWFA mixture cured 28 days

PSU 3852 15kV 10um x1,000

ITZ between cementitious and PA

Microcrack propagation

Asean++ 2013



PSU 3853 15kV 2um x7,500

CONCLUSIONS

The investigation of binary and ternary using RHA and PRWFA in pumice aggregate concrete, the conclusions can be drawn following:

1. Replacing Portland cement with RHA and/PRWFA results in early compressive strengths that are lower than that of the control. However, up to 20%RHA replacements give strengths at 7 and 28 days that are the same as or greater than that of the control.

2. Relative strength of PAC decreased as the level of PRWFA replacement increased. Although RHA gave relative strengths at early ages that are higher than those of PRWFA, the latter provide better performance at extended ages. This is attributed to the higher silica content of ground RHA. Binary and ternary mixtures of each RHA and PRWFA provided up to 20%, and relative strength values at all curing periods were higher than 75%.

3. The substitution of OPC by RHA and PRWFA resulted in an increase in the PAC's electrical resistivity and a reduction in the pore solution of PA. These changes were enhanced by increasing the percentage of the substitution, particularly at replacement levels of 10% and 20%RHA.

4. Effectiveness of RHA on PAC in reducing the expansion due to silica active content in RHA. At 10% and 20% replacements the RHA lightweight concretes give expansion at early exposure that are considerably lower than those of the PRWFA lightweight concretes.

5. No synergistic effect was observed when both RHA and PRWFA were incorporated into the PAC. However, effects of their partial replace by mass of OPC on the compressive strength, bulk density and drying shrinkage are met ASTM C330 requirement.

A photograph of a rubber tree in a forest. A collection cup is attached to the trunk, containing a white liquid (latex). The background shows a dense forest with green foliage. The text "Thank you for your attention" is overlaid in pink, italicized font.

Thank you for your attention

7 2003

วิธีการดำเนินการวิจัย

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ตัวอย่างหินทรายแป้ง

กัณฑ์ขนาด

ถ.พ.

XRD

อิฐดินเผา

บดละเอียด

XRF

LS

หล่อคอนกรีต

Vicat

ไม่บ่ม บ่ม 7 วัน 28 วัน

กำลังอัด

การดูดซึมน้ำ

ความหนาแน่นรวม

ความแข็งกระดอน

วิเคราะห์ XRD, SEM

สรุปผลและเสนอแนะ