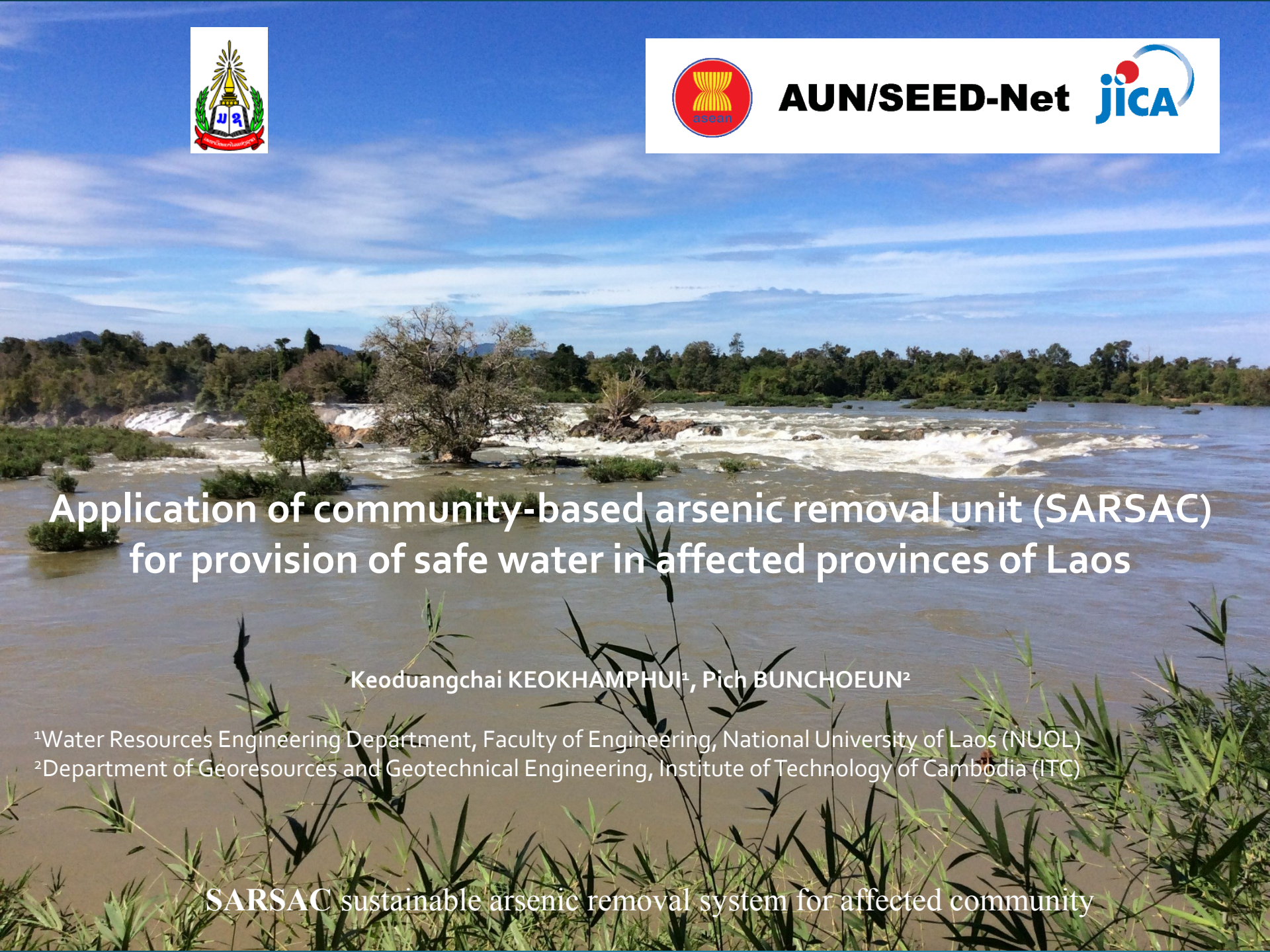

Application of community-based arsenic removal unit (SARSAC) for provision of safe water in affected provinces of Laos

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SARSAC sustainable arsenic removal system for affected community

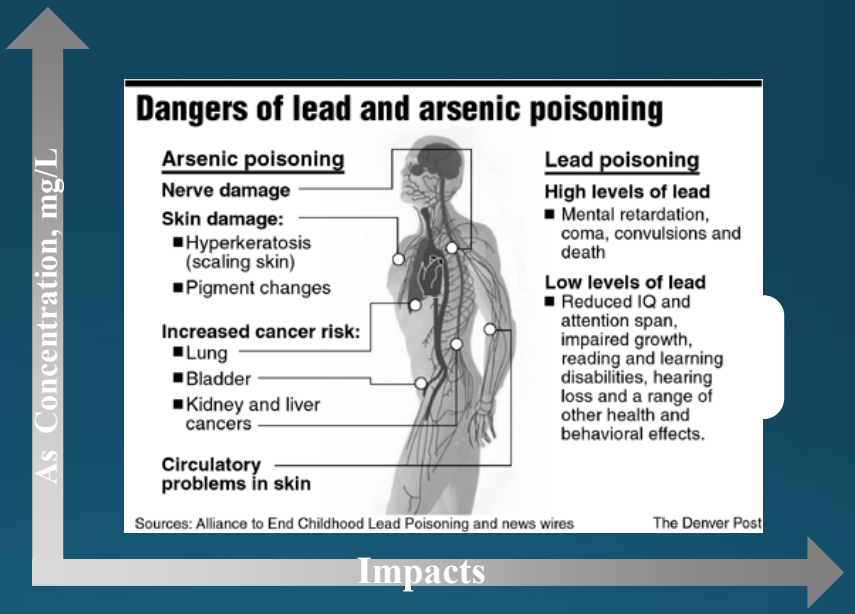
Presentation content

I. Introduction
II. Design of treatment unit
III. Performance of the unit
IV. Conclusion
V. Recommendations

I. Introduction

- As contamination in groundwater is common found in many countries in ASEAN

Laos, Cambodia



- Excessive intake of As can accumulate in the liver, bone for human, and mammals resulting health problems.

I. Introduction

Permissible concentration in surface water and drinking water

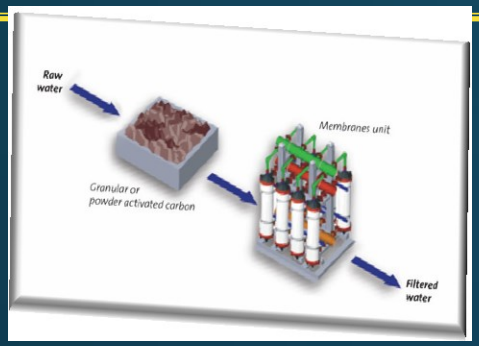
Parameter	Cu	Pb	Cd	As
Concentrations, mg/L	0.25	0.05	0.02	0.05

Remark: As for drinking water (World Health Organization)

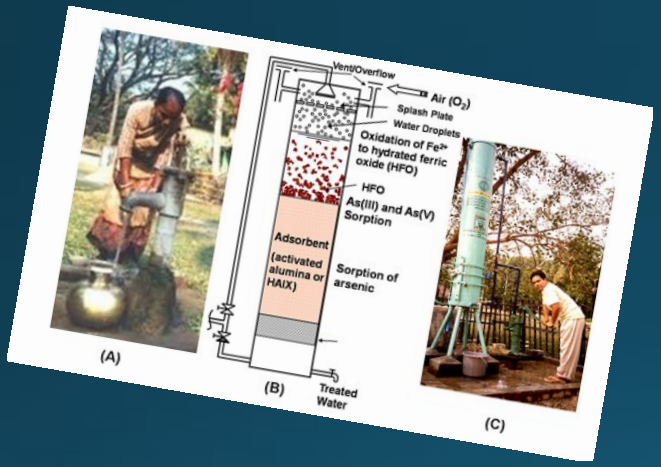
Current treatment technologies are

- chemical precipitation
- Ion exchange
- Solvent extraction
- Oxidation
- Electrolytic extraction,
- Evaporation
- Dilution
- Filtration
- Adsorption, etc.

I. Introduction

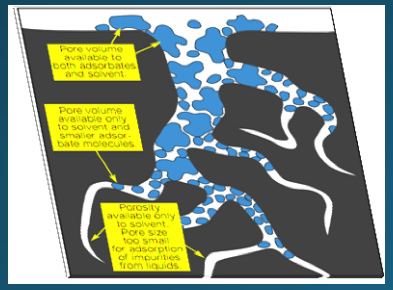


•**Adsorption** is one of these processes that is considered a more efficient removal of arsenic than other processes.



• SARSAC is similar and functional to the **ADSORPTION** process

• Selective adsorbents, utilizing biological materials, waste by- product, mineral oxides, polymer resins, have been studied.



•**HAIX resin is** found to have high efficiency of As removal from groundwater studied by Sakar et al, 2010

I. Introduction

- Three specific objectives are aimed for this study.

1. *To install and promote SARSAC systems at selected locations to remove the arsenic contaminated groundwater*

2. *To test the efficiency and validity of SARSAC system for different types of groundwaters of Laos*

3. *To update or develop the water treatment and use lectures for the undergraduate students, researchers and communities*

II. Design of the treatment units

1. System Installation selection

1. Interview

2.water sample collection and analysis

3. No surface water sources nearby

4. High concentration of As

II. Design of the treatment units

2. Component of the system

No	Items	Volume m^3	function	Remark
1	Stainless steel tank	2000	Raw water	From tube well
2	Stainless steel tank	1000	Rock, gravel, sand	Layer of 20 cm in each layer
3	stainless steel column		Gravel, Haix resin	Gravel layer 20cm, Haix resin 40 cm
4	Stainless steel tank	2000	Clean water	After treatment
5	Water meter	$3m^3/hr$		Measure discharge
6-14	Vale			
15	Effluent			
16	Back wash			

II. Design of the treatment units

1. Maximum flow rate in inlet for the unit is 3-5 m^3/hr

2. Raw water flow through the filter media in second stainless steel tank which contain gravel sized 4-8 cm in the bottom bed, gravel sized 1-3 cm at the middle layer, and sand for the top layer. This filter media is to remove particles that are formed by precipitation of hydrated ferric oxide (HFO) Sarkar et al, 2010.

3. The third stainless steel column consists of gravel at the bottom bed about 20 cm thick, then HAIX Resin layer for about 40 cm. his column is also designed to precipitation of HFO particles and adsorption of arsenic as a polishing step take place at the top part of the column.

II. Design of the treatment units

3. Site locations

Attapeu province	Champasack province
Xaysetta district	Phathoumphon district
Donsim village	Kiet Ngong Village

60 concrete jars are being used

82 boreholes are being used

II. Design of the treatment units

4.Schematic of the unit

Fig.1Map of study location

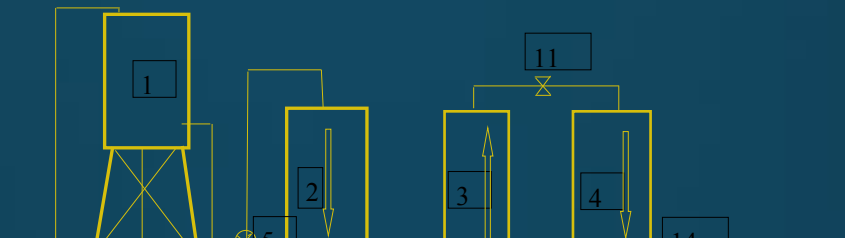


Fig.2 schematic of the arsenic removal unit

(a)

(b)

Fig.2 (a) and (b) Photograph of schematic of the arsenic removal unit at KietNgnong and Donsim villages

III. Performance of the unit

1. Raw water characteristics

- Arsenic contaminated groundwater were found high in both locations in previous report and current survey.
- Low pH has found in one water sample, pH 5.3
- Both locations have warned to close by the district public health office for safety reason

III. Performance of the unit

1. Results from field test (Raw water)

Basic Data for groundwater Monitoring							
5/3/2014							
KietNgong Village, Phathoumphon District, Champasack Province							
Number	location	pH	Tem (	EC(ms)	ORP(mv)	DO(mg/l)	terbidity(NTU)
No 1	School (System location)	7.02	27.8	28.4	-30		4.07
No 2	Mr.Bounsaon	6.96	28	28.5	-30		7.55
No 3	Miss.kiem	5.35	27.1	27.7	264		9.27
	sample no 3 near to watland						
	temple(before filter)						
No 4	temple	6.96	28.8	27.7	-53		31.4
	temple(after filter)						
No 4	temple	7.19	28.3	25.3	27		6.83

III. Performance of the unit

1. Results from field test (Raw water)

	6/3/2014						
Don Sim Village, Xaysetta District, Attapue Province							
Number	Location	pH	Tem (° c)	EC(ms)	ORP(mv)	DO(mg/l)	terbidity (NTU)
No 1	Miss.Von (Systme location)	7.1	28.4	115.8	128		0.29
No 2	Mr.Vieng	7.2	28.2	83.6	107		0.59
No 3	Mr.Am	7.12	28	92.5	109		0.42
No 4	Mr.Veng	7.22	28.9	30.3	112		0.48
No 5	Mr.Sungkayar	7.32	28.9	97.8	113		2.51

III. Performance of the unit

2. Results from laboratory

Parameters	unit	KietNgong						Donsim					
		24/1/14	13/2/14	9/8/14	Treated water	21/9/14	Treated water	25/1/14	14/2/14	9/8/14	Treated water	20/9/14	Treated water
pH		6.71		6.8	6.9			6.98				6.7	6.8
Choloride ion (Cl)	mg/l	11.3	10.63	9,92	9.21	11.3	10.6	10.6	11.34	12.05	13.47	13.5	14.2
Sulfate icon (SO_4^{+2})	mg/l	<2	<2	<2	<2	<2	<2	3.1	3.2	2.6	3.0	3.2	3.5
Total coliform group	MPN/100ml	51	>230	>230	>230	>230	>230	92	>230	>230	0	>230	51
E.Coli		0	0	>23	9.2	>23	>23	2.2	>23	2.2	0	>23	0
Total hardness ($CaCO_3$)	mg/l	130	126	118	78	92	108	426.	446	366	378	372	366
Iron (Fe)	mg/l	1.77	4.74	0.18	0.28	3.62	0.44	N.D,	0.30	0.11	0.23	0.21	0.14
Manganese (Mn)	mg/l	0.024	+	N.D<0.03	N.D<0.03	ND	0.03	0.042	+	N.D<0.03	0.057	0.11	ND
Arsenic (As)	mg/l	0.024	0.081	N.D<0.005	0.006	ND	0.005	0.037	0.30	0.065	N.D<0.005	0.060	ND
Electric conductivity		197.3	+	202	232	250	246	1,075	+	1315	11460	1315	1355
Total dissolved solid		120	122	70	74	80	75	694	665	541	615	564	569

III. Performance of the unit

- Adsorption column acts like a plug flow reactor to adsorpt arsenic concentration in the influent raw water.
- The unit consistently produce arsenic-safe water in a reliable manner.
- Monitoring influent and effluent is needed to determine a breakthrough curve.
- Presently, the unit produce safety water for drinking in both locations.
- Treated water is in the range of permission of Lao water supply state enterprise for drinking water.

IV. CONCLUSIONS

1. Performance of the units is depending on the arsenic and iron concentration in raw water.
2. The arsenic removal units produce on average about 1000 m^3 of treated water before the concentration of arsenic in the treated water exceeds the maximum contamination level, MCL (Sarkar et al, 2010)
3. Community participation is necessary for takecare of the system for the sustainability of the units

V. RECOMMENDATIONS

1. Further investigation of breakthrough curve is a requirement to ensure that treated water does not exceeds the MCL.
2. Encourage Community to participate in operation and maintenance of the units.
3. Regenerate HAIX Resin is needed for further study.


Thank you very much for listening