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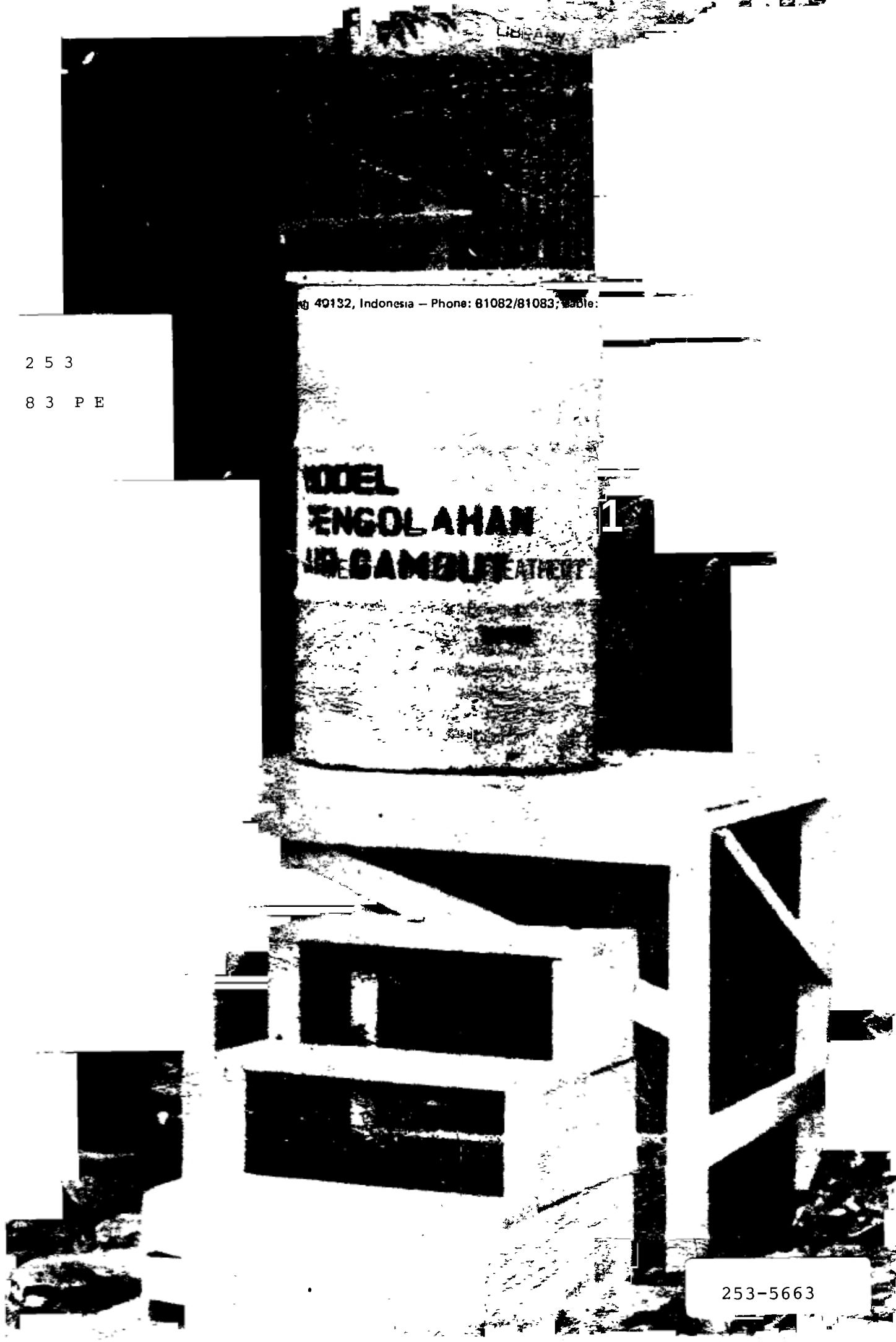

INSTITUTE OF HUMAN SETTLEMENTS
AGENCY FOR RESEARCH AND DEVELOPMENT
MINISTRY OF PUBLIC WORKS
&
REGIONAL CENTRE FOR RESEARCH ON HUMAN SETTLEMENTS
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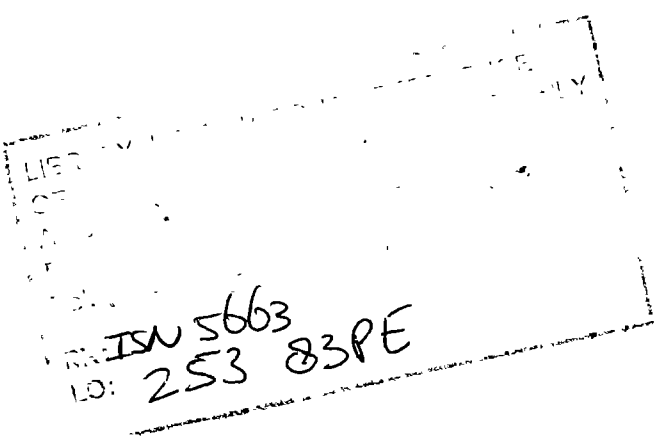
PEAT WATER TREATMENT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CONTENTS

PEAT WATER TREATMENT

I. INTRODUCTION.

1.1. G e n e r a l.

On this earth, water absolutely necessary for human being and one of importance element to increase the quality of human life. How important the water is, several effords have been achieve to gain the clean water either for individual or groups by using the. very simple up to advanced technology.

One of the Governments effords is to increase the wellfare of community, that is the afford to provide the clean water that can only supply at least half of community needs in the city and rural areas. In the framework of the equality development and to increase the wellfare of community in rural areas so it is needed that the clean water could reach them.

In order to achieve the objectives as mentioned above, the chosen technology should be relevant with 3 (three) items; i.e. finance, materials and man power. Financially, the technology should be according to the budget available and if a budget is limited choosen technology should be a low cost. From materials point of view, so choosen technology should be beneficial as much more the local Should be use the local materials and known by the

community. And from man power point of view, choosen technology should be appropriate one.

For that purpose, [redacted] the Directorate of Building Research (now the Institute of Human Settlements) under the Agency of Research and Development, Ministry of Public Works lead by Mr. Karman Somawidjaja has been carried out several field of research for water supply in crisis areas (tidal areas) but has potential for water resourses called "peat water". In those areas (tidal areas), the peat water is used by community for daily life such as bathing, washing, cooking etc, beside they the use of rain water.

As we know, the peat water is the surface ground water which is available in the tidal areas with specific charateristic that is brownish colour, bad smelling odor and sour taste. The quality of those water essentially unadequate for dringking water and it doesn't fulfill the requirement of Health Departement of the Republic of Indonesia, so that it needs treatment before used.

Praise be to God, that through His guidance, and the assistance at several parties, the researcher of the Institute of Human Settlements has been carried out successfully to process the peat water into clean

water by using the local materials (peat clay as coagulant and absorber and sand media filter) throught the appropriate technology. This is called "Individual Instalation For the Purification of Peat Water".

1.2. Historical Research.

Especially for the community in tidal areas which are unreached by the clean water supply, traditionally of the daily life for bathing, washing and cooking uses the peat water because no other choice beside the rain water.

Geografically, the tidal areas in Indonesia is approximately 24 million hectar and scatered most in Kalimantan, South Sumatra, Riau and Jambi. Some part of the tidal areas are already occupied by the transmigrant. In this cases, in relation with the new settlements (transmigrant) the problems will be more complex, particulary in supllying the clean water.

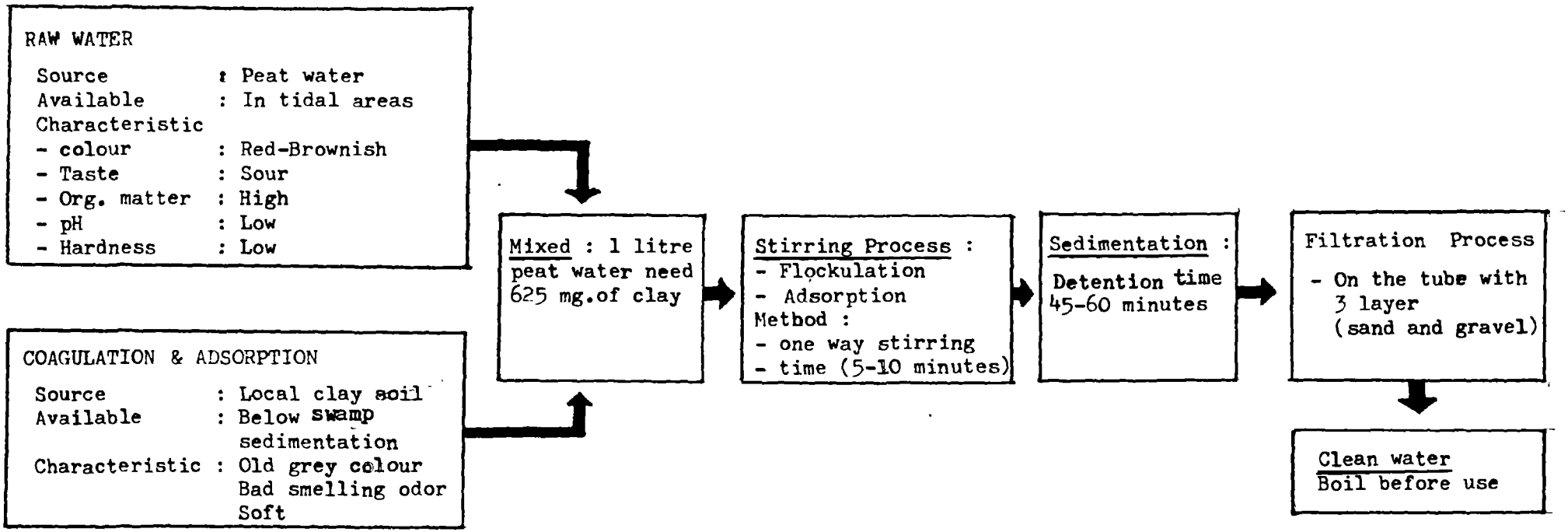
Based on that fact as mentioned above, the team of the Institute of Human Settlements lead directely by the Director has visited to south Kalimantan and midle Kalimantan for studying the local resources that might to be developed as clean water. For that

purpose some sample has been collected such as peat water, white sand, kuartsz sand, woods, clay etc., to research the possibility of the benefits of it and this has been experimented in the Laboratory at the Institute of Human Settlements.

In laboratory, research of peat water has been carried out to treat it into clean water for dringking and cooking, either using the common method of water treatment or several method based on the past experience of the local community such as using "kelor", (Matingga Alivera sheeed as coagulant and desinfectant) coconut shield, and antrasit (as filter),clay soil, etc. In this laboratory, research more intensified to obtain the treatment method of clean water. In the field, several researches have been carried out for reserving the clay soil and sand and traying the peat water installation model. Until now it has been done at Kalimantan (south, midle and west Kalimantan), South and West Sumatra, and Riau and for installation model experiment has been carried out in the transmigration areas at Kalimantan dan Sumatra. This research has been carried out in some phases and until now is still being contineously achieve to the final objectives, that is the installation system of peat water for the whole tidle areas in Indonesia.

II. TECHNICAL DATA

DIAGRAM OF PEAT WATER TREATMENT



II. TECHNICAL DATA.

A. Raw Material.

A.1. Peat Water.

Peat water is obtained at the surface water or from water which is available in tidal areas. The peat water has a charateristic as follows :

- Colour : red-brownish
- Teste : sour
- Organic matter : high
- pH (acid degree) : low
- Hardness : low

The peat area in Indonesia is scattered at Kalimantan, Sumatera and Irian Jaya.

Seen from the chemical analysis, the colour of peat water particularly is enfluenced by a high organic matter so that the peat water will be acid.

The humic acid is to form the colour at surface water or around water in tidal areas. The quality of peat water in some part areas has in variety and easy enfluenced by the area characteristic such as soil structure, plants, thickness of humus, age of humus etc. The sample quality of peat water from several area is shown on table 1.

Table 1. The quality of raw water from several location of peat water. (Kalimantan and Sumatera).

Elements	Unit	I	II	III	IV	V	F		
							A	B	C
Colour	Unit PtCo	753	527,31	752	1315	1125	-	5	50
Turbidity	mg/l SiO2	32	0	0,50	5	9	-	5	25
DHL	u mhas/cm	-	30	50	760	75	-	-	-
pH	-	4,10	3,94	3,62	6,01	4	6,5	-	9,2
Organic Matter	mg/l KMnO4	287,30	193,72	172,40	290	243,40	-	-	10
CO2 Agresive	mg/l	-	neg	30,99	-	80,57	-	-	0,0
Hardness	D	2,05	0,48	-	5,51	1,44	5	-	10
Calsium	mg/l	neg	neg	-	4,54	0,0	-	75	200
Magnesium	mg/l	8,83	2,06	-	20,9	6,19	-	30	150
Iron	mg/l	neg	neg	neg	neg	0,0	-	0,1	1,0
Mangan	mg/l	neg	neg	neg	neg	0,0	-	0,05	0,5
Chloride	mg/l	11,11	5,48	-	161,6	18	-	-	600
SO4	mg/l			5,1	11,23	-	-	-	-
HCO3	mg/l	neg	51,39	-	-	-	-	-	-

Remarks

I = Peat Water from South Kalimantan

II = Peat Water from West Kalimantan
III = Peat Water from Centre Kalimantan
IV = Peat Water from South Sumatra
V = Peat Water from Riau
VI = The Dringking Water Requirement from the Health Departement of Republic of Indonesia.

A = The minimum to be allowed
B = The minimum to be suggested
C = The maximum allowed

These peat water is doesn't fulfill the requirement at Health Departement of the Repubic of Indonesia. So for the daily needs should be process into the clean water.

A.2. Raw Materials for Peat Water Treatment.

The proposed of raw material for peat water treatment are potential local materials for treatment a peat water into clean water and there are available in the tidal areas.

The raw materials are as follows :

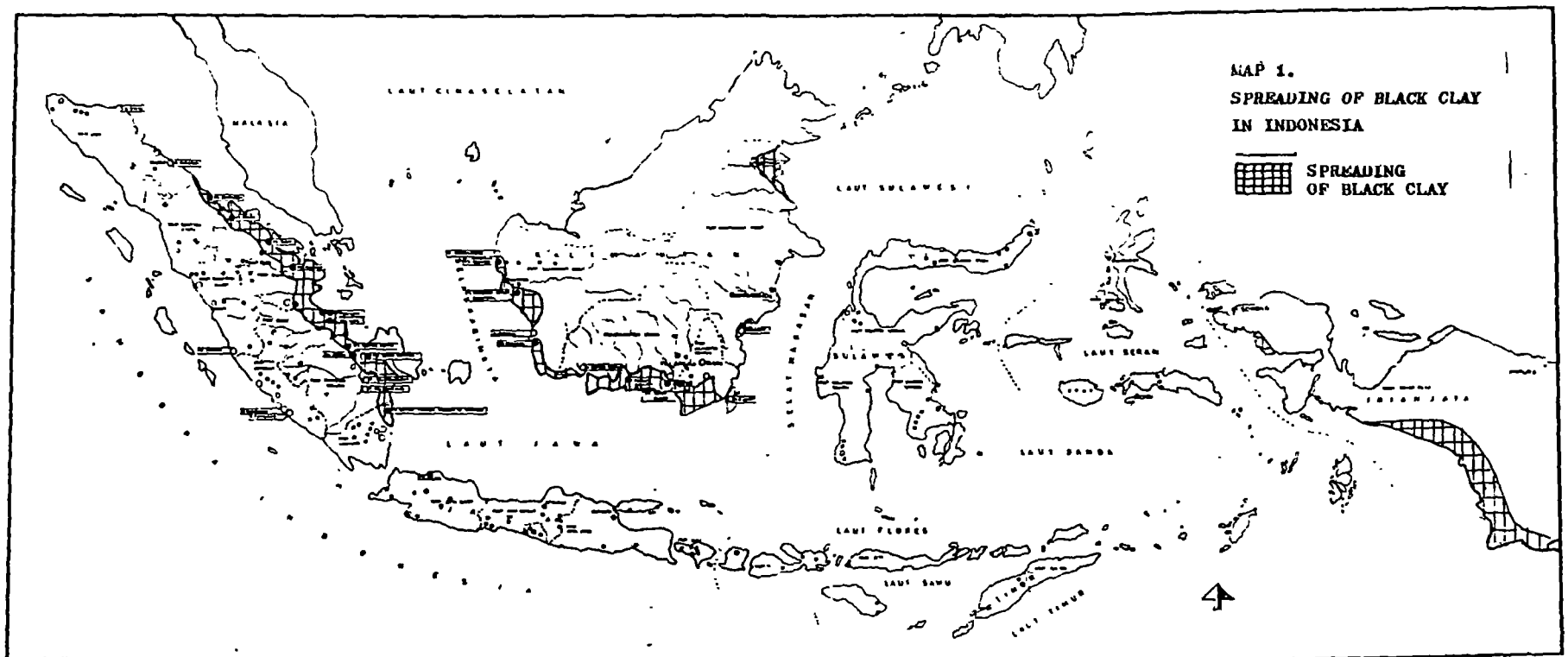
a. Local clay soil.

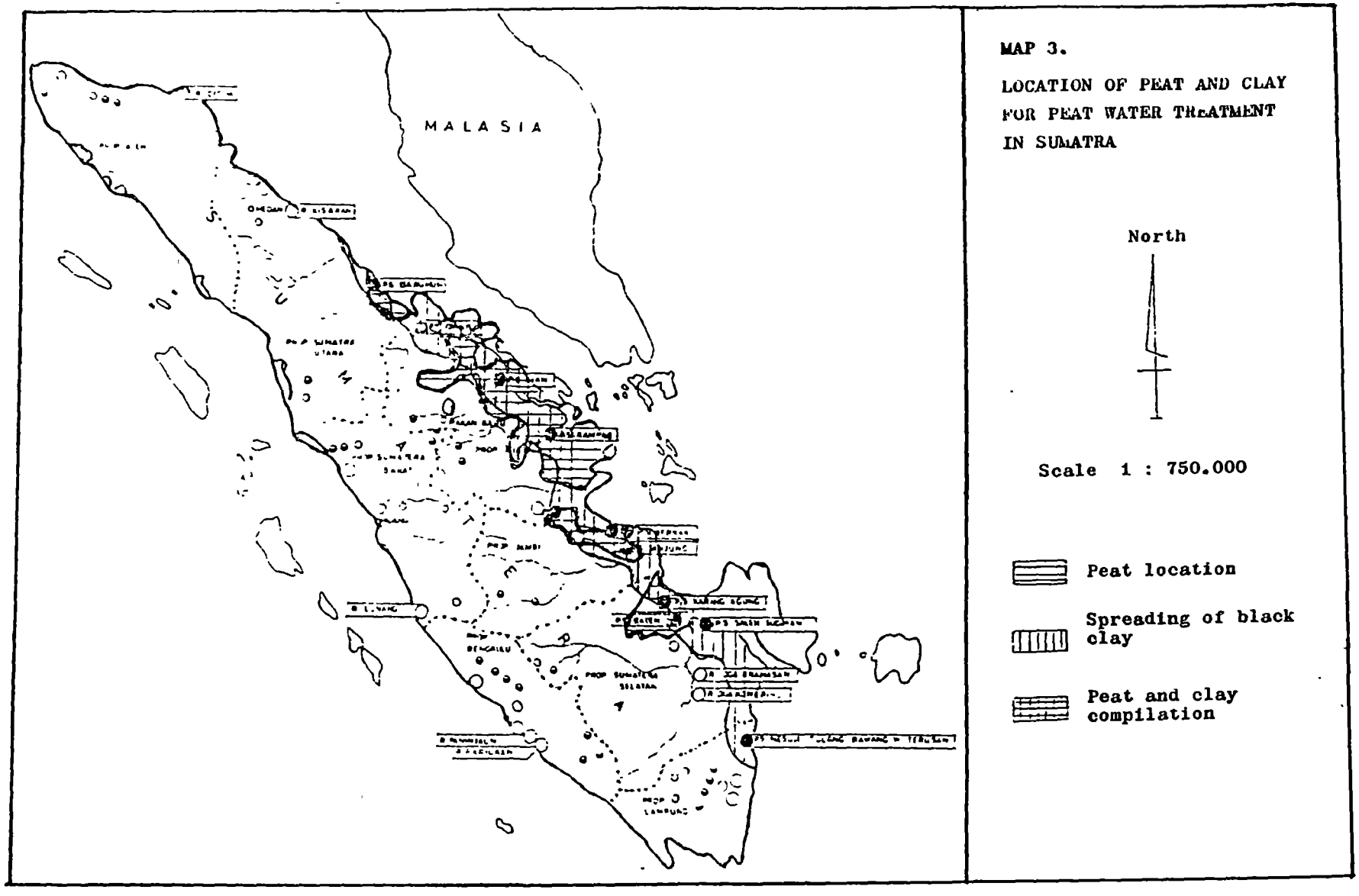
The charateristic of clay soil for the peat water treatmentit is grey-blackness in colour, bad smelling odor and available under the sediment of swamp or in tidal areas. The clay soil is found at the river bank or at the result of the digging of the canal. In each location, the efectivitas of clay soil for peat water treatment is in variety and the clay soil which is used is gained from the tidal areas such as South Kalimantan, South Sumatra and Riau.

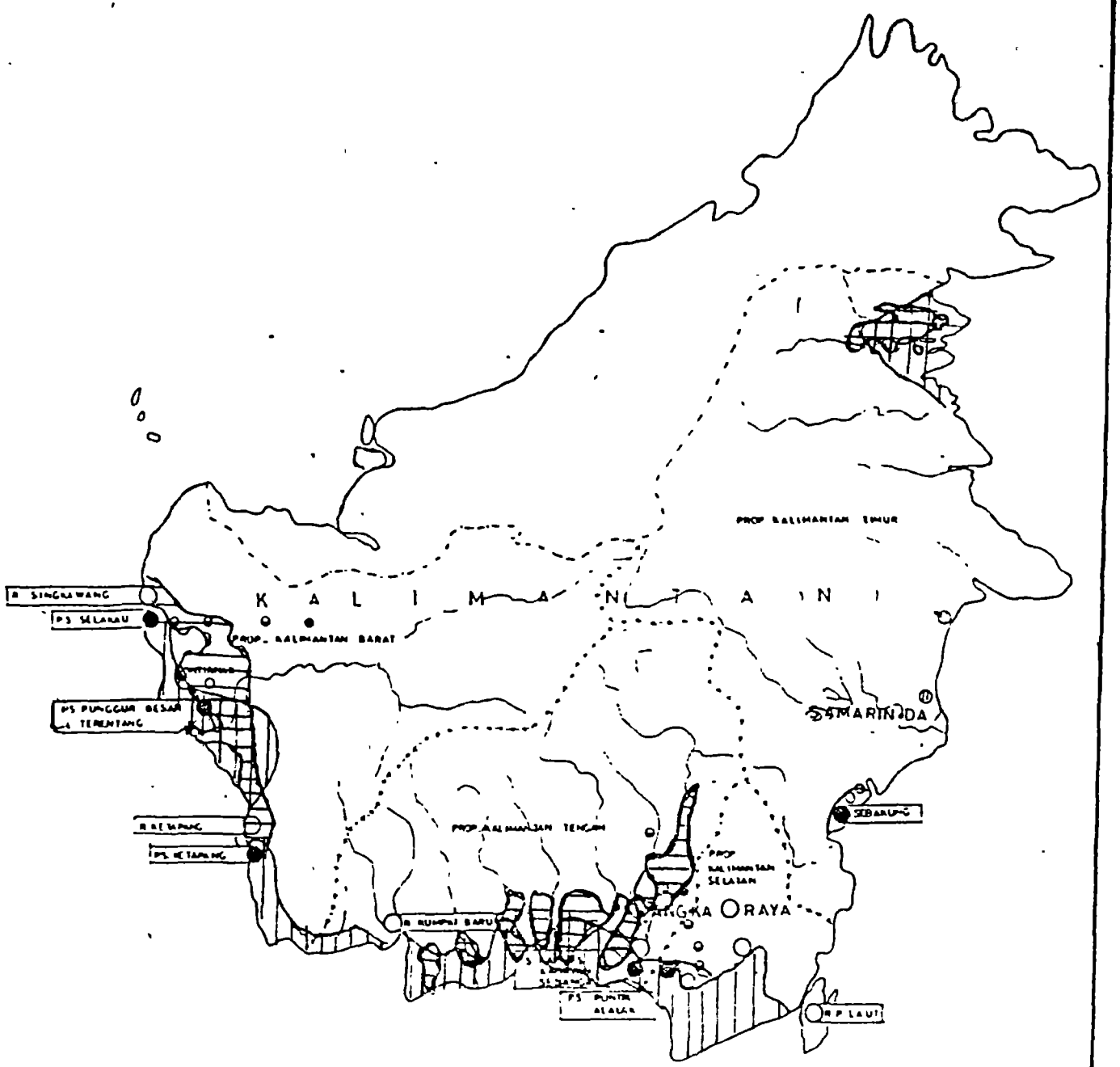
The composition of clay soil is :

$$Fe\ Al_2\ (SO_4)_4\ 22\ H_2O$$

Seen from that chemical formula and the content,


MAP 1.
SPREADING OF BLACK CLAY
IN INDONESIA
SPREADING
OF BLACK CLAY


MALASIA
MAP 3.
LOCATION OF PEAT AND CLAY FOR PEAT WATER TREATMENT IN SUMATRA
North
Scale 1 : 750.000
Peat location
Spreading of black clay
Peat and clay compilation



MAP 2.

LOCATION OF PEAT AND CLAY FOR PEAT WATER TREATMENT IN KALIMANTAN

North

Scale 1 : 750.000

Peat Location

Spreading of black clay

Peat and clay compilation

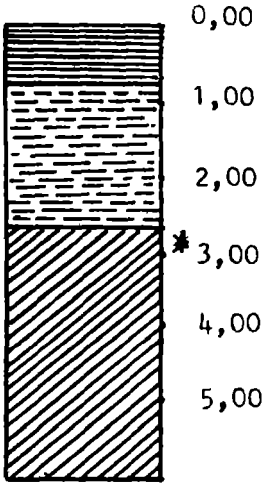
that is might be function for coagulation and absorption and that clay soil is possibly polluted by kwarzst, pirit, micca and alumunium. One of the sample of clay soil as a chemical analysis result is shown below :

No.	Element	Percentage
1.	SiO_2	43,52 %
2.	Al_2O_3	32,34 %
3.	Fe_2O_3	13,68 %
4.	Ca O	0,52 %
6.	Mg O	0,54 %
7.	SO_3	3,56 %
8.	HP	19,01 %
9.	C	2,44 %
10.	B.J	2,22 %

Based from survey in the field, most of the clay soil is located at aluvium land which is formed by swamp aluvial sedimentation and river. These clay soil which is formed by sedimentation of lumps/flocks marine. The depth of sedimentation is in variety from 0.5 up to 3.5 metres and scattered in the main river bank, which is enfluenced by tidal of the sea. The section underground layer as shown below there is a black clay soil on the second layer. This clay unequal

scattered both the form and qualities. Generally these clay is found at certain depth and shown in the figures below :

The section of underground layer.

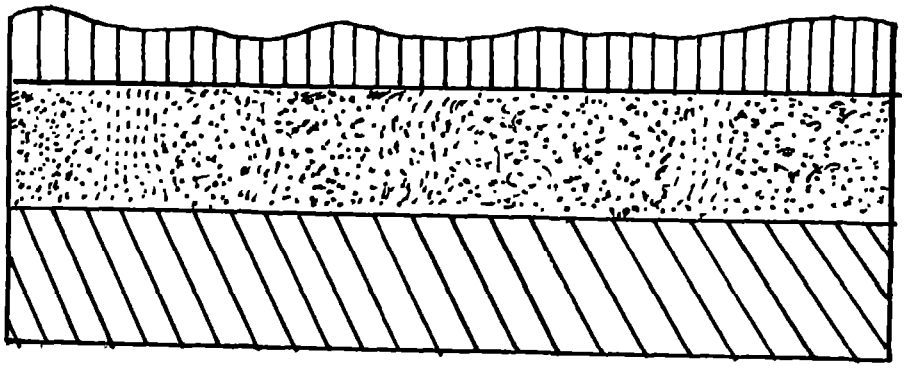


covered soil (peat Soil)

Clay soil (light grey up to old grey), soft plastic.

*) Old grey clay, soft and sandy, contain from wood fragment and coal.

Note :
*) The clay soil can be used to treat the peat water.



The soft covered layer

The layer where is clay soil sedimentation available

Bottom layer

This clay as coagulation function to loose some part of dissolved organic, microorganisme such as flankton and bacterial and another dissolved that caused the turbidity of peat water. Based on result of the research in laboratory, every one litre of peat water treatment need approximately 625 mm clay soil of South Kalimantan.

b. Media Filter/Sand Filter.

Some several of location study are found several sand is cointained of quarzst (SiO), CaO, Mg O , Fe, Al and another chemical composed and with the variety of gravel. The local sand containing quarzst with a gradition of 0.3-1.2 mm is used as a filter. In general, the local sand which is used as filter is obtained from sand at the river and even these sand olso used for building materials. The thickness at sand filter should be 0.7 - 0.9 mm and not containing at clay soil, organic matter etc. For the installation which has been designed, the media filter are as follow

- layer 1 (foundation), gravel 0 (12-10 mm), thickness 15 cm.
- layer 2 (centre), gravel 0 (0.3-1.2 mm), thickness 70 cm.
- layer 3 (top), gravel 0 (12-30 mm), thickness 15 cm.

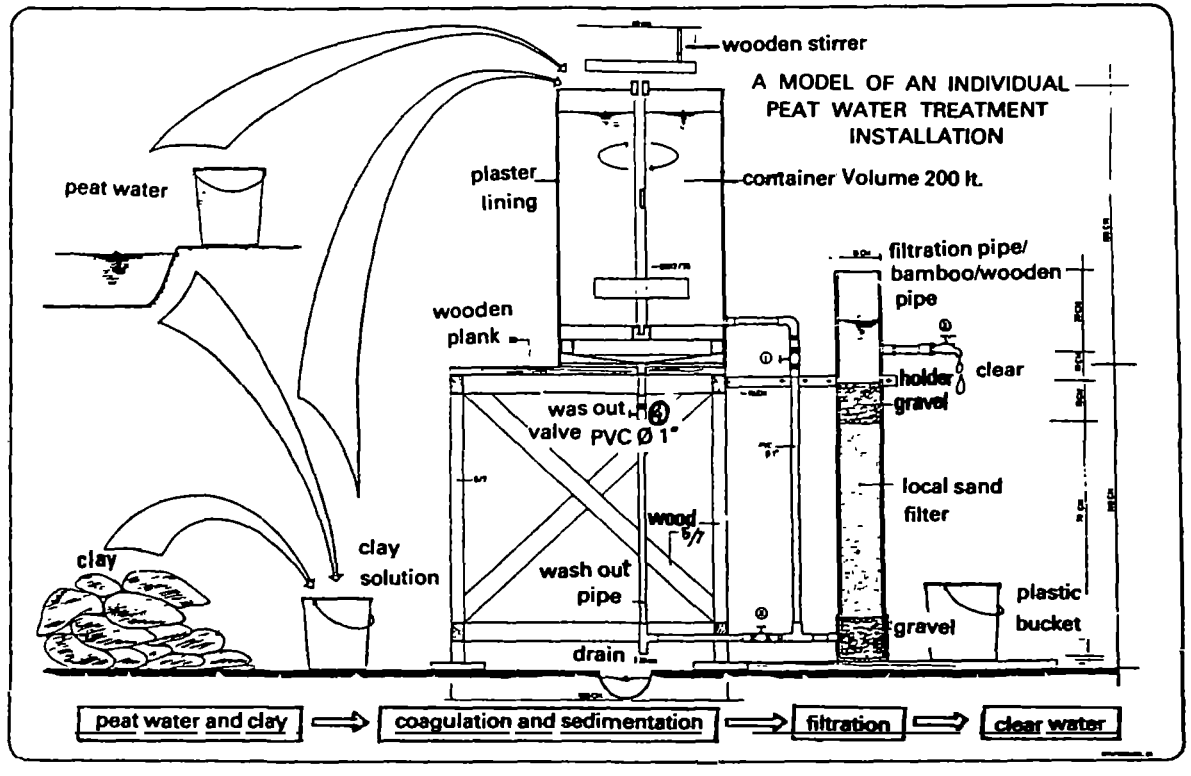
A.3. Materials of Peat Water Treatment Installation

As mentioned above, the result in laboratory reference that the peat water has a specific characteristic such as low acid degree and high agresive CO2 and that is causes high corrotion to some of materials. So the installation of peat water treatment should be made by material which is ressistant from corrosive.

The sample installation model of peat water treatment which has been designed by the Institute of Human Settlements is contained from materials are as follows : (see drawing on page 18).

- The capacity of container is approximately 200 litres. Can be made by iron drum and used for fulfill peat water, mixed coagulationt, flockulation, adsorption, absorption and sedimentation.

- P V C pipe.
  Used for filter tube; 0.6 inch.
  Used for connecting pipe to the filter tute 0.1 inch diameters for filter of water.
- Taps and valves, made from the brass.
- Stirring and support construction for container, made from woods.


A MODEL OF AN INDIVIDUAL PEAT WATER TREATMENT INSTALLATION
wooden stirrer
container Volume 200 lt.
plaster lining
peat water
wooden plank
filtration pipe/ bamboo/wooden pipe
holder
clear
gravel
was out valve PVC Ø 1"
local sand filter
wood
clay
clay solution
wash out pipe
plastic bucket
gravel
drain
peat water and clay
coagulation and sedimentation
filtration
clear water

The expence for installation model of peat water treatment amount up to approximately Rp. 50.000,- (US $ 50 , price in October 1983).

B. **Peat Water Treatment Process.**

Basically, there are 3 phases for the peat water treatment, that is :

- Phase 1.

  Mixed and stirring, floculation and colour absorption. On this phase, there is a contact between the clay soil particles and chemical composed with kolodial characteristic which is found in peat water to forms flocks and adsorption colour that can be settled. On this way, there is a contact either physically and chemically. The coagulation process to reduce some part of disolved organic matter of peat water.

- Phase 2.

  Sedimentation.

  On this phase there is flock sedimentation which is occured on the phase 1. The detention time of sedimentation approximately 45-60 minutes.

- Phase 3.

On this phase, a filteration is done for the soft particle which has not yet come into sedimentation. It is done throught filter tube with sand media filter that contain of quarzst, calsium, and magnesium etc., with a gradition of 0.3-1.2 mm. and thickness 70 cm.

In this filtration there is an increasing pH (acid degree), hardness, Ca, Mg and acoording to requirement of dringking water from Health Department of the Republic of Indonesia.

The quality of peat water after treatment process is shown on the table 2.

Tabel 2. The Quality of Peat Water after Treatment Process.

No.	Element	Unit	Before treatment		After treatment with clay, 625 mg/l		The qualities Requirement from Healt Dept. RI.		
			I	II	I	II	A	B	C
1.	Colour	(Unit PtCo)	903,63	770,00	11,30	15,00	-	5,00	50,00
2.	DHL	(u mhos/cm)	30,00	67,00	250,00	200,00	-	-	-
3.	Turbidity	mg/l/SiO2	30,00	4,40	0,00	1,00	-	5,00	25,00
4.	pH	-	4,53	3,64	7,27	6,82	6,5	-	9,20
5.	Iron (Fe)	mg/ltr	1,20	neg	neg	0,00	-	0,10	1,00
6.	Mangan	mg/ltr	neg	neg	neg	0,40	-	0,05	0,50
7.	Hardness	(D)	0,39	0,43	4,76	5,76	5,00	-	10,00
8.	Calcium	mg/ltr	neg	neg	14,56	26,40	-	75,00	200,00
9.	Magnesium	mg/ltr	1,67	1,85	11,69	8,87	-	30,00	150,00
10.	Chloride	mg/ltr	6,14	4,40	2,57	10,90	-	200,00	600,00
11.	Organic matter (KMnO4)	mg/ltr	149,57	244,60	12,87	12,11	-	-	-
12.	HCO3	mg/ltr	24,41	-	38,54	19,27	-	-	-
13.	CO2 agre-sive	mg/ltr	16,68	38,51	neg	2,78	-	-	-
14.	Nitrite	mg/ltr	neg	neg	neg	neg	-	-	-

Remarks

A = The minimum to be allowed
B = The minimum to be suggested
C = The maximum to be allowed

I = detention time 1 hour
II = detention time 24 hour
a = after sedimentation
b = after filtration

C. **Operational Guidlines.**

- Pour approximately 200 litres of peat water into a container; turn off all the taps and valves.
- Dissolved approximately 40 eatspoons full of clay (about 0.5 kg) with about 2 litres of water in a small pail.
- Pour this solution into the container throught a sieve, and then mix by stirring for 5-10 minutes.
- Leave the water on the the drum for 45-60 minutes for settling of the flocks. Turn on valve 1 and 3 to obtain the clean water.

Note : The sand filter should stay submerged in water, whether in operation or not.

D. **Maintenance Guidlines.**

- Container (drum) Cleaning.

  Clean the container each time after use, with the following these steps :

  - turn off valve 1 and 2
  - turn on tap 4 (wash out) and then rinse it with water until clean.

- Filter Cleaning.

  Clean the filter at least once a week, or if the water which comes out at tap 3 becames turbid or coloured. In this phase the following steps should be taken :

- turn off valve 1,4 and tap 3 and then turn valve 2
- turn off valve 1, 3 and 4 and then turn on valve 2 (wash out).
- pour the clean water slowly into the filter tube until the water which comes out of valve 2 is clean.
- take out the gravel on the top of filter tube and then wash in the pail.
- turn on valve 1, pour water from drum until the sand comes up and the water is full in the tube.
- pour the clean water from the top of tube into the filter tube and then rinse it untill the water which comes out from valve 2 is clean.
- turn off valve 2 and the gravel after washed take in into the filter tube.
- the filter tube is ready for use.

III. CONCLUSION.

The result of peat water treatment by using the local clay could be concluded as follows :

1. The local clay can be used as a material of peat water treatment in the tidal areas.
2. The effectivitas of local clay as a material of peat water treatment is found variety is some areas.

3. Generally, the water quality after treatment by using the clay according to fulfill requirment of the Health Department of the Republic of Indonesia.
4. In the mean time, the individual installation model of peat water treatment is favorable and agreeable for the tidal areas and particulary in the transmigration area at Kalimantan, Sumatra and Irian Jaya.