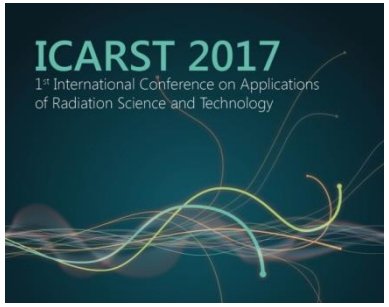

United Nations
Educational, Scientific and
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Asia Pasific Centre
For Ecohydrology
Under the Auspices of Unesco

LIPI

RESIDENT TIME DISTRIBUTION DETERMINATION OF IPAG60 IN ORDER TO INCREASE EFFICIENCY OF DRINKING WATER TREATMENT PLANT FOR PEATLAND AREA

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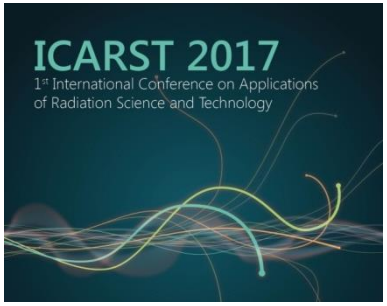
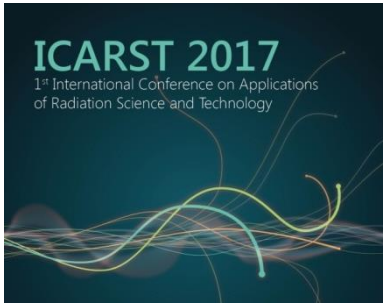
Background

- The majority of areas in Riau Province and Midle Kalimantan Province have the land with peat surface water.
- The characteristics of the peat water are: low pH levels (2-4) that is highly acidic; high levels of organic; high levels of iron and manganese; yellow or dark brown.
- This kind of surface water is basically not suitable as raw water for drinking water.
- Compared with other surface water that is fresh water, the water from the turf needs to be processed specifically by adding stages in the process.
- Peat water treatment technology that has been established in previous studies allows the peat areas have peat water treatment facility for drinking water supply.



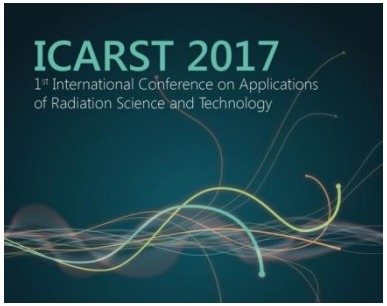
Aims of the Study

- Implementation of IPAG60 is to support the increase in water services in the region.
- In order to improve the efficiency of water treatment plant, it would require :
  - assessment study of the pilot plant related to water quality
  - Determination of the resident time distribution of IPAG60.

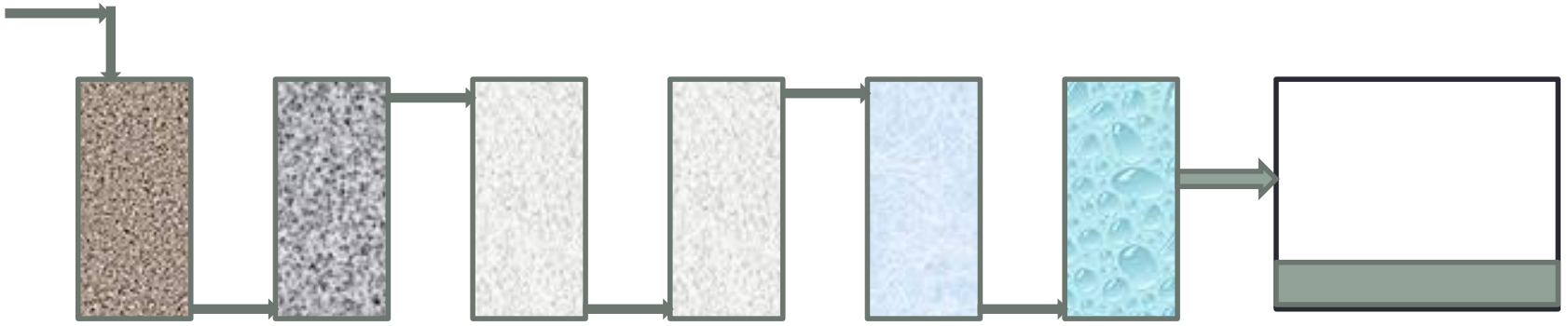


Location of Study

- The research was conducted in two different locations:
  - Katingan, Central Kalimantan Province
  - Bengkalis, Riau Province

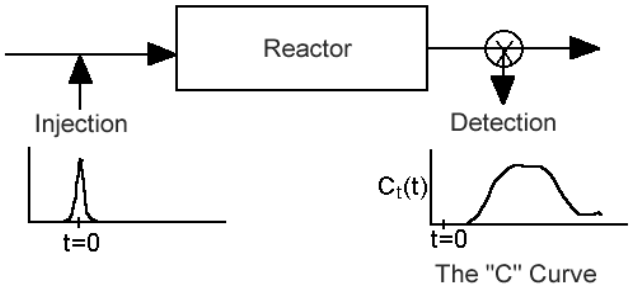


6 CSTR in serie



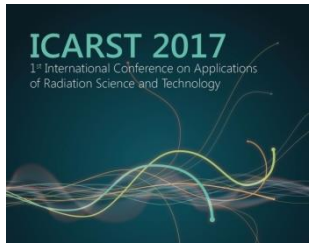
- **RTD is determined experimentally by;**

1. **Injecting** an inert **tracer**,into the reactor at t=0
2. Measure the **tracer concentration** ,C in the effluent.



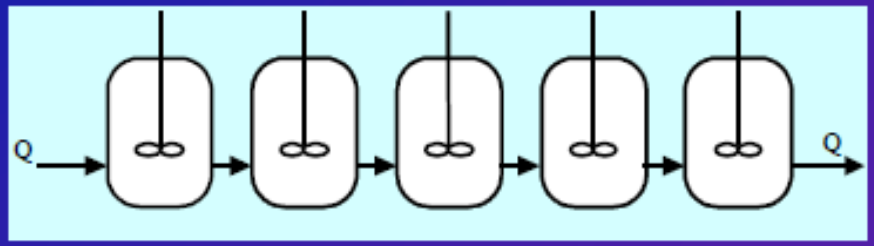
Li tracer will be used *:*

- *availability*
- *accuracy*
- *easyness.*



Bil
réac

Mass Balance of CSTR in Serie



Nomb

Bilan

Mass Balance in A

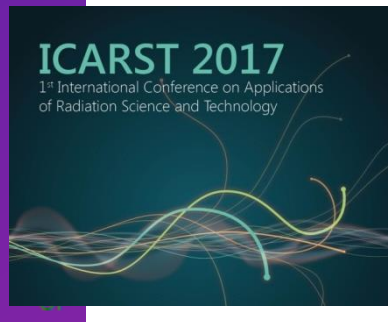
$$Q.C_{A\,i-1} + r_{Ai}.V_i = Q.C_{Ai} + V_i \frac{dC_{Ai}}{dt}$$

Pour u

For 1st order kinectic reaction

$$\Delta C_{A\,i} = \left(\frac{Q}{V_i} . \left(C_{A\,i-1}(t) - C_{A\,i}(t) \right) - k.C_{Ai}(t) \right) . \Delta t$$

$$C_{A\,i}(t + \Delta t) \approx C_{A\,i}(t) + \Delta C_{Ai}$$

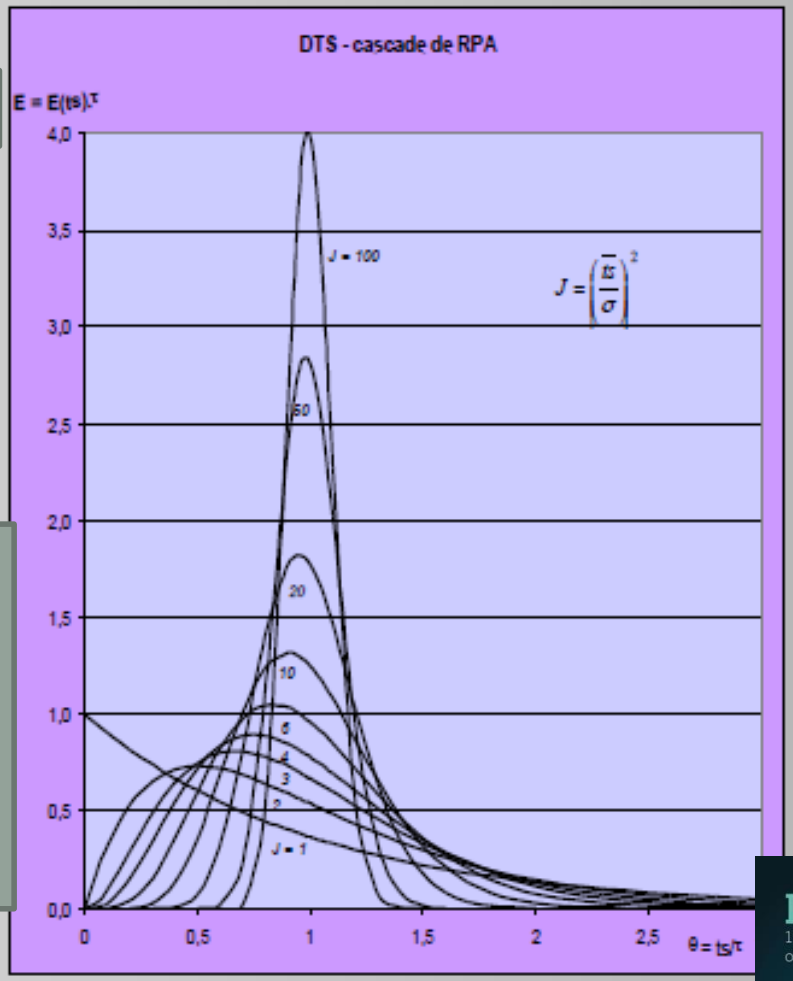


CSTR in serie

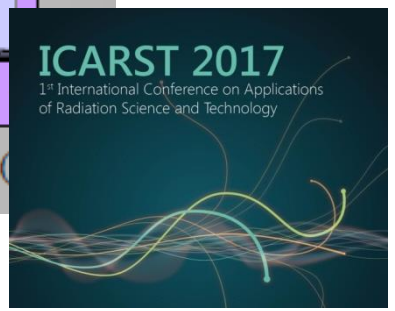
DTR in relation with no of J

$$E(ts) = \left(\frac{J}{\tau}\right)^{J} \frac{ts^{J-1}\exp\left(-J.ts/\tau\right)}{(J-1)!}$$

Optimal Q = 1 L/s
(60 L/minute)

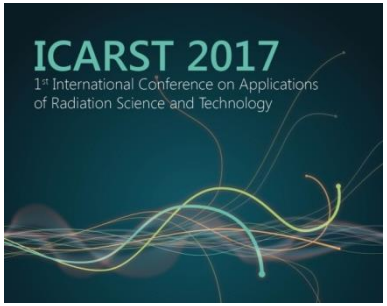


graphe en coordonnées réduites : $\theta = ts/\tau$ et $E = E($

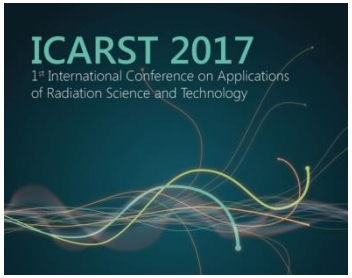


PROCEDURE AND ANALYSIS

- Peat water sample taken from
  - the raw water intake of installation
  - the processed water taken from the reservoir tank of IPAG.
  - water samples testing based on three parameters : physical, chemical, and biological analysis
- Assessment of peat water characteristics including:
  - color detected by a colorimeter at 455 nm wave length,
  - taste,
  - conductivity measured by conductivity TDS meter,
  - turbidity using turbidymeter,
  - temperature and salinity

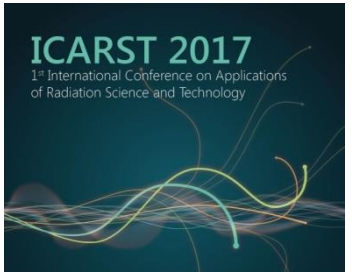


- Chemical parameter analysis :
  - non metallic content : pH, sulphate, total organic mater (TOM), ammonia, nitrate, nitrite, hardness, cyanide, fluoride, total N, phosphate, total P, and phenol.
  - metal content : Hg, As, Fe, Cd, Zn, Cu, Pb, Mn, Ca, Mg, total Cr
- Biological parameter analysis :
  - Pollutant indicator bacteria observed were total E. coli and Coliform.
  - Colony count methods (Oliver, 1999)
  - 0.45 nm porous cellulose membrane placed on a sterile filter device using tweezers.
  - Filtered water samples with a volume of 100 ml and 50 ml.



Water Quality Classification

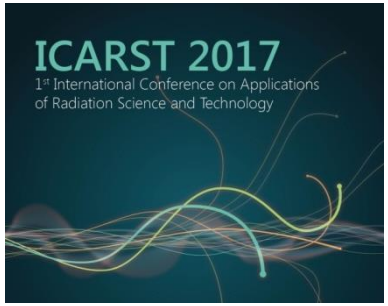
- Using the of STORET scoring method (Minister of Health Regulation No. 115/2003).
- This method aims to determine the status of water quality that is commonly used.
- The principle of this method is to determine water quality status by comparing water quality data with water quality standards in accordance with its designation (MOE Decree No.. 115 of 2003).
- The way to determine the status of water quality is to use the value system of the US-EPA (Environmental Protection Agency) to classify water quality into four classes A, B, C and D with matching score of maximum, minimum and average with the classification of water quality standards



Classification of water quality status by STORET method

Number of Parameter	Values	Parameter		
		Physical	Chemical	Biologycal
<10	Maximum	-1	-2	-3
	Minimum	-1	-2	-3
	Average	-3	-6	-9
>10	Maximum	-2	-4	-6
	Minimum	-2	-4	-6
	Average	-6	-12	-18

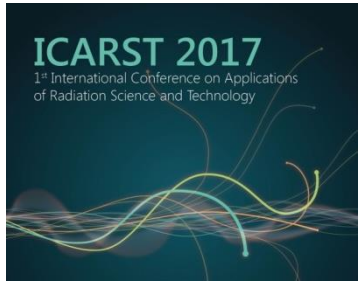
Classification	Status	Water quality	Score
Class A	Good	Meet the standard	0
Class B	Fair	sligthly polluted	-1 s/d -10
Class C	Bad	Polluted	-11 s/d -30
Class D	Very Bad	Highly polluted	≥ -31



Results of physical quality analysis

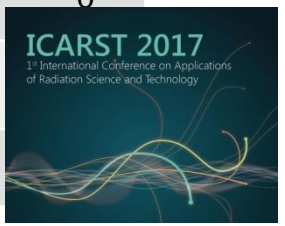
No	Parameter	Unit	Standard *)	Peat water	Score	Clean water By IPAG	Score
1	Colour	TCU	15	374	-1	4	0
2	Odour	-	No odour	Odour	-1	No odour	0
3	Taste	-	No taste	Acid	-1	No taste	0
4	Turbidity	NTU/FAU	5	25	-3	0	0
Total skor					-6		0

No	Parameter	Unit	Standard *)	Peat water	Score	Clean water By IPAG	Score
1	Colour	TCU	15	462 - 503	-1	2	0
2	Odour	-	No odour	Odour	-1	No odour	0
3	Taste	-	No taste	Acid	-1	No taste	0
4	Turbidity	NTU/FAU	5	7.5	-1	1	0
	Total skor				-4		0



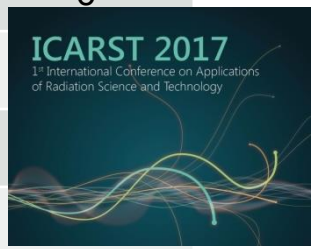
Results of chemical analysis by STORET

No	Parameter	Unit	Standard *)	Peat water	Score	Clean water By IPAG	Score
1	Total (Fe)	mg/l	0,3	0,414	-2	0.021	0
2	Manganese (Mn)	mg/l	0,1	0,061	0	0.038	0
3	pH	-	6.5 – 8.5	2.82	-2	7.0	0
4	Ammonia (NH3-N)	mg /l	1.5	ttd	0	0.027	0
5	Nitrate (NO3-N)	mg /l	50	0.177	0	0.308	0
6	Nitrite (NO2-N)	mg /l	3	0.036	0	0.006	0
7	Total N	mg /l	-	0.566	0	0.859	0
8	Phosphate (PO4-P)	mg /l	0.2	0.429	-2	0.014	0
9	Total P	mg /l	0.2	0.9398	-2	0.017	0
10	Sulphate (SO4)	mg /l	400	32.21	0	3.894	0
11	TOM	mg /l	-	619.42	0	0.617	0
12	Hardness	mg /l	500	Ttd	Ttd	ttd	
	Total score				-8		



Results of chemical analysis by STORET

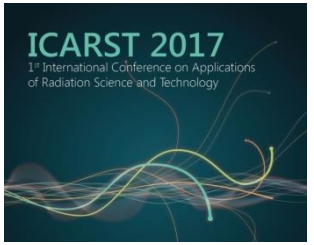
No	Parameter	Unit	Standard*)	Peat water	Score	Clean water By IPAG	Score
1	Total (Fe)	mg/l	0.3	0.174	0	< 0.009	0
2	Manganese (Mn)	mg/l	0.1	0.071	0	0.039	0
3	pH	-	6.5-8.5	3.52	-2	6.7	0
4	Ammonia (NH3-N)	mg/l	1.5	0.511	0	0.310	0
5	Nitrate (NO3-N)	mg/l	50	1.109	0	0.064	0
6	Nitrite (NO2-N)	mg/l	3	0.042	0	0.002	0
7	Total N	mg/l	-	0.323	0	0.167	0
8	Total P	mg/l	0.2	0.109	0	0.030	0
9	Sulphate	mg/l	250	38.80	0	71.53	0
10	TOM	mg/l	-	438.16	0	19.86	
11	Hardness		500	735	-2	353	
	Total score				-4		



Results of microbiological analysis by STORET score

Parameter	Standard*) (col./100 ml)	Peat water (col/100ml)	Score	Clean water By IPAG	Score
E. *Coli*	0	78	-3	0	0
Coliform	0	109	-3	0	0
Total			-6		0

Parameter	Standard*) (col/100 ml)	Peat water (col/100 ml)	Score	Clean water By IPAG	Score
E. Coli	0	70	-3	0	0
Coliform	0	630	-3	0	0
Total			-6		0



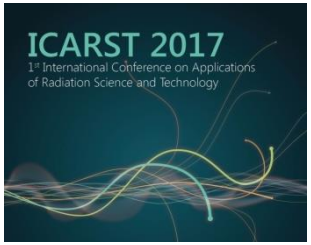
Water quality before and after treatment by IPAG60

No	Parameter	Before	After
1	Physical	-5	0
2	Chemical	-8	0
3	Biology	-6	0
Total		-19	0
Status of water quality		Polluted	Meet the standard

No	Parameter	Before	After
1	Physical	-4	0
2	Chemical	-4	0
3	Biology	-6	0
Total		-16	0
Status of water quality		Polluted	Meet the standard

Conclusions

- IPAG60 was tested in two locations: Sala River in Central Kalimantan Province and Air Raja River in Riau Province.
- The main water treatment plant consist of 6 CSTR in serie, with optimal operation at Q = 1 L/s (60 L/minute)
- Based on water quality analysis using the STORET score, it can be concluded that IPAG60 has been able to increase the quality of peat water coming from two different rivers, from class C (polluted status) to class A (good status).
- it will provide an alternative technology to provide clean water access in peat land areas



THANK YOU FOR YOUR ATTENTION ...!