

Use of EM Technology for controlling foul odors and sanitation concerns caused by massive flood in Thailand in 2011

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Abstract—The 2011 flooding crisis was the worst in half a century in Thailand. The floods actually began in northern Thailand in May and continued through January, ultimately submerging 65 of Thailand's 77 provinces, including seven major industrial estates north of Bangkok. The floodwater in the area of submerged landfills produced polluted water with foul odors. In addition, since a household sanitation system was unable to operate under floodwater, individuals that remained in flooded areas exposed themselves to risks and also increased the risks for those living downstream by producing more sewage and trash in the water. The stagnant water and water pollution promoted the growth of pathogens and mosquitoes. Technology of effective microorganisms (EM) was used to improve foul order and to reduce concerns about sanitation.

Keywords—effective microorganisms, flood, foul order, sanitation, Thailand,

I. BACKGROUND AND OBJECTIVES:

A. The worst flooding yet in terms of the amount of water and people affected

Severe flooding which broke out at the end of July 2011 in Thailand affected more than two-thirds of the country. The flood spread along the Mekong and Chao Phraya river basins through the north, northeast and central provinces. In October parts of Bangkok were also inundated. In some areas, the floodwater persisted until mid-January 2012, resulted in a total of 815 deaths and affected 13.6 million people. It has been described as “the worst flooding yet in terms of the volume of floodwater and the number of victims”.

Floodwater in the area of submerged landfills produced foul odors (Fig 1). As the sewage problems reached critical levels in 14 central provinces (Nakhon Sawan, Uthai Thani, Singburi, Chainat, Ang Thong, Saraburi, Ayutthaya, Suphanburi, Lopburi, Nakhon Nayok, Nakhon Pathom, Pathum Thani, Nonthaburi, Chachoengsao) in October, the Prime Minister appointed the Ministry of Natural Resources and Environment, the Ministry of Defense and the Royal Thai Army Forces as central organizations to solve the sewage problems. The

stagnant water and water pollution promoted the growth of pathogenic bacteria and pests such as mosquitoes and flies, which resulted in the spread of dengue fever, malaria, cholera and other diseases which are detrimental to our health.

In order to mitigate the suffering of the affected people, EM technology was used to improve foul order, water quality and to reduce concerns about sanitation. After the water drained, EM was also used for cleaning streets, people's houses, etc.



Fig.1. Areas around the landfills submerged due to flood in Phisanulok Province

B. Effective Microorganisms (EM)

EM Technology is a people-friendly and environmentally safe technology that exploits synergistic effects by combining beneficial microorganisms such as lactic acid bacteria, photosynthetic bacteria and yeast. EM microbial solution and Activated EM (AEM), activate native microorganisms that inhabit in soil and water, and maximize their natural power.

The introduction of EM into Thailand was initiated in 1986. Full-scale utilization started in 1989, after the 1st International Nature Farming Conference was held at Khon Kaen University in Thailand. After that, “Saraburi Kyusei Nature Farming Center” was established in Saraburi province, located in the center of Thailand, to promote EM and nature farming. This center regularly organized workshops and people from home and abroad participated to learn about EM and nature farming. Also, following the economic crisis in 1997, the King of Thailand advocated a “self-sufficient economy”, which meant a shift towards a more self-reliant and localized economy. Part of this project was for farming villages, and the Royal Thai Army

to learn about EM and nature farming at this Saraburi training center to achieve the national project. Therefore, the Royal Thai Army has been proactively using EM for almost 20 years to improve people's living environments and to achieve regional development based on this philosophy.

II. METHODS

A. Sewage Purification

On 29th of October 2011, sewage purification started using EM technology at the flood-affected landfills of 30 rai (1 rai = 1,600m²) in Bang Rakam District, Phitsanulok Province. The total amount of AEM used was 300,000 liters and the number of EM mud balls used totaled 70,000. Subsequently, on 10th of November 2011, sewage purification started using EM technology at the landfills of 9 rai in Rong Chang Village of Maha Rat District, Ayutthaya Province. The total amount of AEM used was 30,000 liters and the number of EM mud balls used was 30,000 (Figs 2a, 2b, 2c and 3d). In order to see the effect of AEM on water quality, officials of the pollution control office from the Ministry of Natural Resources and Environment measured at several areas the dissolved oxygen (DO) value before and after EM treatment.



Fig. 2a. Army General Pichet Wisajorn is explaining how to use EM mud ball for sewage treatment



Fig. 2b. Throwing EM mud ball into submerged landfills producing offensive odors



Fig. 2c. Spraying AEM to suppress foul odor and pathogenic bacteria and pests such as flies and mosquitos



Fig. 2d. Army General Satian Permtongin and the executive committee are pouring AEM for sewage purification

B. SEMINARS

A seminar about solving sewage problems using EM technology was held on 17th of November in 2011 at the Thai Army Club for governmental organizations, private institutions and residents. Topics included were how to purify stagnant, putrid and offensive odor producing sewage with EM Technology. Experts also explained how to prevent diseases

such as leptospirosis, mycosis and tinea. On 6th of December 2011, another seminar was held at the same location. At this seminar, the lecturers emphasized how to restore residences after the water drained, because many of the affected people needed advice on how to clean and restore their homes. Both seminars included a workshop on how to activate EM and how to make EM mud ball. As many as 1,000 people participated in each seminar and they all received EM, molasses and explanatory leaflet (Figs 3a and 3b). These seminars provided information on how to use EM under various situations and were able to considerably mitigate the participants' anxiety.



Fig. 3a. Experts giving lectures on sewage treatment using EM



Fig. 3b. Around 1,000 people attended the seminar

C. Free distribution of AEM at various locations

From 11th of November to 10th of December 2011, an AEM service unit was established at the Army Sports Stadium in Bangkok. A total of about 450,000 liters of AEM were distributed to the residents free of cost. From 22nd of November, service units were established at 5 other Army installations in Bangkok and other damaged provinces along the Chao Phraya River, i.e. Ayutthaya Province, Lopburi Province, Saraburi Province and Nakhon Pathom Province. Ten thousand liters per day of AEM were distributed to the residents at each service unit and the amount totaled about 1,500,000 liters altogether (Figs 4a, 4b, 4c and 4d).



Fig. 4a. Preparing AEM for distribution



Fig. 4b. Many residents came to take AEM



Fig. 4c. Distributing AEM at Ayutthaya Province



Fig. 4d. Royal Army distributing AEM to residents

Moreover, approximately 150,000 copies of EM water treatment explanatory leaflet were printed and distributed to residents in all affected areas (Fig 5).



Fig. 5 EM water treatment leaflet

III. RESULTS

1. DO value of the landfill areas

The DO value of the areas around the landfill (48,000 m²) located in Bang Rakam District, Phisanulok Province, was 0.6 mg/L on 29th of October 2011. On 10th of November 2011, 12 days after EM treatment, the DO value increased to 4 mg/L. The DO value of the landfills (14,400m²) located in Rong Chang Village of Maha Rat District, Ayutthaya Province, was 3.4 mg/L on 10th of November 2011. On 16th of November 2011, 7 days after EM treatment, the DO value increased to 4.5 mg/L. Regarding the water quality in Bung Bua Village, before EM purification the DO value was 0.5 mg/L on 22nd of November 2011. On the 29th November 2011, 7 days after the purification, it was 2.0 mg/L (Fig 6). In general, fish cannot survive in the pond and river where DO is less than 2.0mg/L and foul odor comes up.

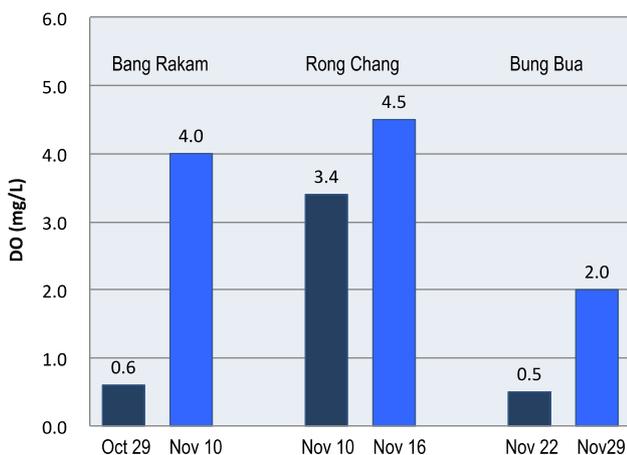


Fig. 6. EM application improved dissolved oxygen (DO)

2. Reports from the affected area

Sewage purification was conducted effectively and systematically by the Ministry of Natural Resources and Environment, the Ministry of Defense and the Royal Thai Army Forces. The predetermined objective of solving the sewage problems in affected areas was accomplished. They were convinced that they were able to ease the suffering of affected people. Residents who used AEM for the purification of water reported that, after the purification, foul odor disappeared and the occurrence of mosquitoes was markedly diminished. Essentially, there was no report regarding the epidemic caused by pathogens and pests, although its occurrence was much concerned at the beginning of flooding. Experts inferred that the clarification of water is due to the decomposing ability of EM for putrid substances.

IV. CONCLUSIONS

Use of EM technology is effective against odors and sanitary control at the time of massive flooding. EM may also be effective at preventing the outbreak of epidemics by controlling the growth of pathogens and mosquitos.

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