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# *Kempong*, A Traditional Fermented Food in Karangpucung Kidul Village, Linggapura Bumiayu, Central Java: Fermentation Agent and Their Roles

Devia Kusmawati Arfina, Endang Kusdiyantini, Isworo Rukmi[*)]

Department of Biology, Diponegoro University, Semarang, Indonesia
[*)]Corresponding author, email address: rukmi_is@yahoo.com

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**Abstract**

*Kempong* is a traditional fermented food that is found only in South Karangpucung, Linggapura Bumiayu village, Central Java. It is made from palm kernel cake (PKC). This fermented food is consumed mostly everyday by the people in the village as a side dish or snack. Study on the mold that plays an important role in the kempong fermentation was done by isolating molds from kempong, PKC, *laru* and the air of preparation room. Eleven species of molds were successfully isolated from different samples. Among the mold isolates, three species came out from kempong product, i.e. *Rhizopus oryzae, Eurotium chevaliery* and *Aspergillus oryzae*. The isolates showed the capability in producing amylase, protease, lipase, and cellulase. Both *R. oryzae* and *A. oryzae* indicated as the main fermentation mold in kempong production, because the inoculum *laru* only contained these two species.

***Keywords***: *kempong,* mold, fermentation, palm kernel cake

## Introduction

Indonesia has a various traditional fermented foods. These kinds of foods are different and specific in every parts of the country. One of them is *kempong*, which is a traditional fermented food prepared from palm kernel cake (PKC). It is produced and consumed by the people in South Karangpucung village, Linggapura, Bumiayu Central Java. *Kempong* is a black cake covered by white mold, which is produced by mold mycelium. PKC is a solid byproduct of oil extraction from kernel of palm *Elaeis quainensis* Jacq using mechanical or chemical method. PKC contains water (less than 10%), high fiber especially cellulose (60%), fat, protein, arabinoxylan, glucoronoxylan, and minerals. Protein content in PKC is 15.73-17.19%. It is lower than protein content in soybean meal (Firahmi, 2007).

*Laru* is used as an inoculum for *kempong* fermentation. It is prepared from previous *kempong* product by scrapping the mold mycelium from kempong surface. It is then collected and further dried. Traditional preparation of *kempong* is simple. The solid PKC of palm oil is soaked for 12 h. It is heated by steaming for 5 h to soften the substrate and further cooled for 2 h. The cooked PKC is then inoculated with *laru*. It is spread on rectangular bamboo trays and covered with banana leaves. Subsequently, it is incubated for 36 h in a dark place at ambient room temperature. Grown mold mycelium on the surface of product is scrapped and collected in the *laru* container for next *kempong*

production (Sunimah, 2012-personal communication).

Nutrition contents of PKC were 15.14% protein, 6.08% lipid, 17.18% fiber, 17.18% calcium and 0.72% phosphor (Widjastuti et al., 2007). Fermentation of PKC has been done for several years. It might improve the values of the metabolize energy when PKC was used for monogastric animal feeding (Oluwafemi, 2008). It is interested that PKC in Bumiayu region is used as substrate for production of a specific traditional fermented food called *kempong*. However, to the best of our knowledge, there was no information on the microorganism involved in *kempong* fermentation. Therefore, the objective of this study was to explore the mold, which was having an important role in the *kempong* fermentation process.

**Materials and Methods**

Five *kempong* samples were collected from traditional market in Karangpucung Kidul Village, Linggapura, Bumiayu. PKC and *laru* were also collected from the *kempong* producer in the village. Direct isolation of molds from *kempong* was done by slicing the product and put on potato dextrose agar (PDA) plates containing 100 ppm of chloramphenicol. Mold from PKC and *laru* were isolated by dilution method on PDA. Representative the grown mold colonies on the plates after 5-7 days incubation at 28°C was transferred on to PDA slant. Examination of the presence molds in the air of kitchen and incubation room was also conducted by opening PDA plates for 15 min and further incubated at 28°C for 5-7 days. Mold isolates were then examined for their enzyme activities, i.e. amylolytic analysis was performed on PDA containing 2% starch, proteolytic analysis was performed both on skim milk agar (skim milk 8 g/L; agar 15 g/L) and on 15% gelatin, while cellulase activity was observed on CMC (2.7 g/L CMC; 1.755 g/L $NaNO_3$; 1.755 g/L $KH_2PO_4$; 0.81 g/L $MgSO_4.7H_2O$; 0.01 g/L $FeSO_4.H_2O$; 0.081 g/L yeast extract; 4.59 g/L agar). Identification of mold isolates were done based on macro and micromorphology observation of mold cultures grown on malt extract agar (MEA), czapek's yeast extract agar (CYA), and czapek's yeast extract 20% sucrose (CY20S) media according to Samson et al. (2010) and Klich (2002).

**Results and Discussion**

Eleven mold isolates were obtained from *kempong* product and processing, including *kempong* product, PKC, *laru*, and air of kitchen. Isolates were identified according to Samson et al., (2010) and Klich (2002) as shown in **Table 1**. Isolates were species of Aspergilli, Eurotium and Rhizopus.

**Table 1**. Molds isolates found in the *kempong* making process

| No | Isolate | Kempong | PKC | Laru | Incubation room | Kitchen |
|---|---|---|---|---|---|---|
| 1 | *R. oryzae* | + | | + | + | + |
| 2 | *A. niger van Tieghem* | | + | | + | + |
| 3 | *A. carbonarius* | | | | + | |
| 4 | *A. ochraceus* | | | | + | |
| 5 | *E. chevalieri* | + | | | + | |
| 6 | *A. oryzae* | + | | + | + | |
| 7 | *A. flavus* | | | | + | + |
| 8 | *A. nidulans* | | | | + | + |
| 9 | *A. fumigatus* | | | | + | |
| 10 | *A. glaucus* | | | | + | + |
| 11 | *A. parasiticus* | | | | + | + |

Only three species of molds have been isolated from *kempong*. Two of them i.e. *R. oryzae and A. oryzae* were proven come from *laru*, which were used as starter inoculum. While *E. chevalieri* might presence as a contaminant from the incubation room environment. The enzyme activities of these three isolates were observed by examination of the activity indexes of the main enzymes in this particular fermentation process. All mold isolates from *kempong* showed the capability in producing amylase (**Fig. 1**), protease (**Fig. 2**), cellulase (**Fig. 3**), and lipase (**Fig. 4**). These enzyme activities had an important role in *kempong* fermentation process, because PKC was containing of high protein, fat, carbohydrate and cellulose.

*R*. *oryzae* has been widely known as fermentation agent in many traditional fermented foods in Indonesia. This species have the capability in producing several enzymes such as protease, lipase, and particularly amylase (Steinkraus, 1996). *R*. *oryzae* and *A. oryzae* isolates produced high proteolytic activities, which were not significant different. While *A. oryzae* produced high cellulolytic activity, which was similar with those from *E. chevalieri* isolate. They have also been known as food fermentation agent in many Asean countries like Indonesia and Japan, because of its capability in producing several enzymes like protease, lipase and particularly amylase (Berka, et al., 1992, Steinkraus, 1996, Samson et al., 2010). A*. oryzae* plays an important role in degrading cellulose in the substrate in this *kempong* fermentation, because of its high cellulolytic activity (**Fig. 4**).

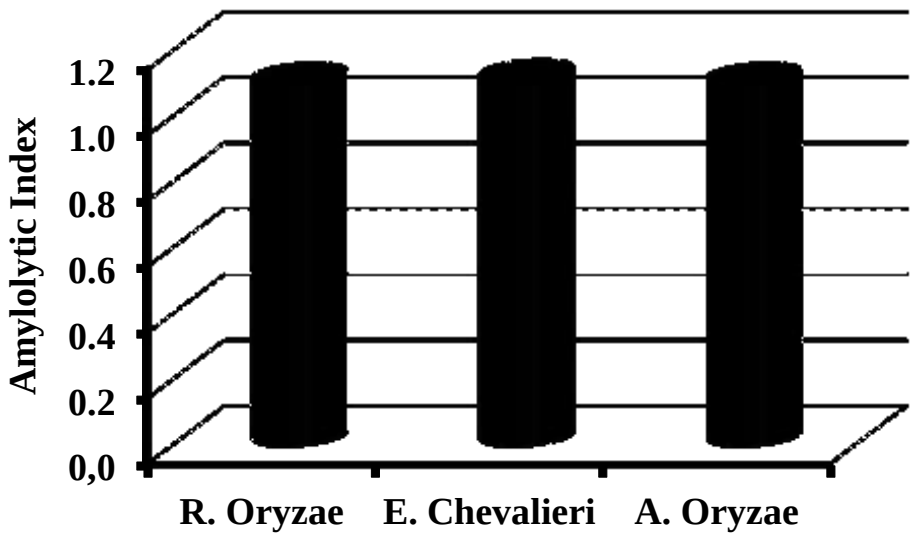


**Fig. 1** Amylolytic activities of molds isolated from *kempong*

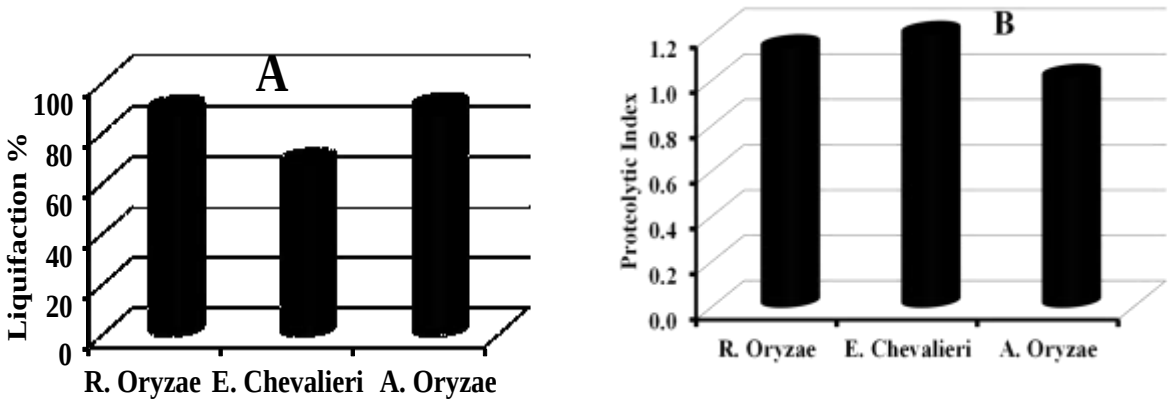


**Fig. 2** Proteolytic activities of molds isolated from *kempong* on gelatin (A) and skim milk (B)

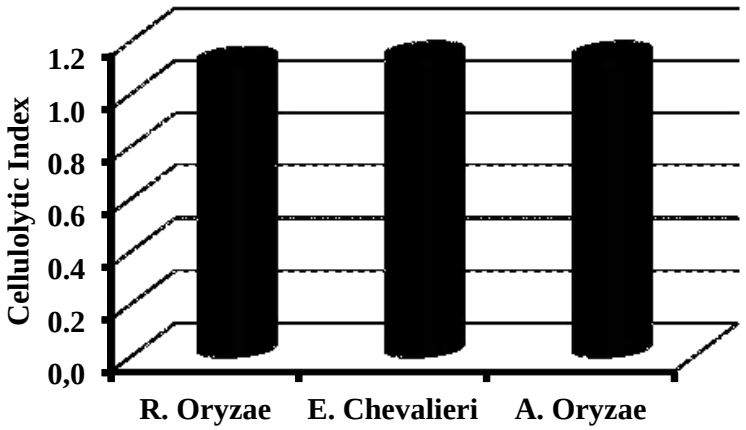


**Fig. 3** Cellulolytic activities of molds isolated from *kempong*

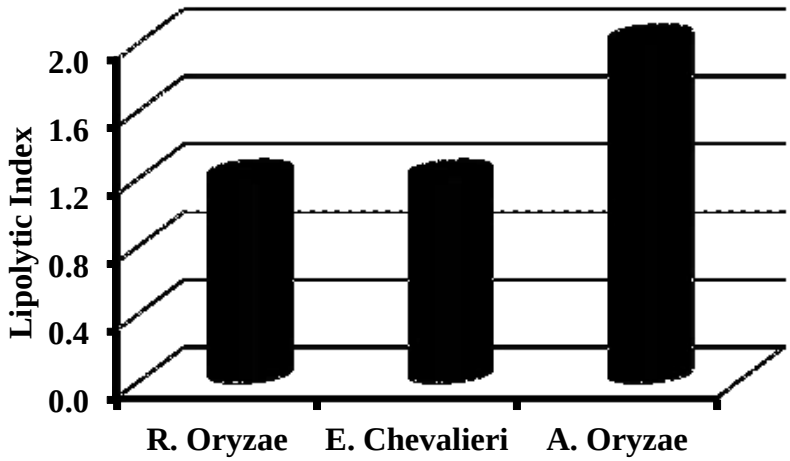


**Fig. 4** Lipolytic activities of molds isolated from *kempong*

**Table 2**. Composition of PKC*, kempong*, *tempe kedele* and *tempe gembus*

| Nutrient | PKC | Kempong | Tempe Gembus*) | Tempe Kedele**) |
|---|---|---|---|---|
| Water (%) | 10.10 | 74.03 | 84.9 | 64.0 |
| Protein (%) | 17.70 | 5.77 | 4.0 | 18.3 |
| Fat (%) | 11.96 | 2.60 | 2.1 | 4.0 |
| Carbohydrate (%) | 55.16 | 16.67 | 8.4 | 12.7 |
| Ash (%) | 5.20 | 0.67 | 1.4 | - |

*) Tempe gembus: refuse of soybean curd (tahu) factory (Steinkraus, 1996)

**) Tempe kedele: soybean (Steinkraus, 1996)

The composition of PKC, *kempong, tempe kedele* and *tempe gembus* are presented in **Table 2**. Results showed that all nutrients in the fermented PKC decreased after fermentation, except the water content. An increase in water content in *kempong* can be explained as a retention of some forming water due to the metabolic activity of molds during fermentation process. The nutrient composition of *kempong* was more or less same with tempe gembus, which was produced from solid byproduct of soybean curd factory. Based on the decreasing of all nutrient content and the enzymatic activities of three mold isolates, which were observed in this study, it was proved that the molds isolates played an important role in *kempong* fermentation. The decreasing of nutrient content of components during PKC fermentation was also found in winged been seed (*Posphocarpus tetragonolobus*) fermentation, which was produced as winged bean tempe during a fermentation of winged bean seeds (Steinkraus, 1996).

*Kempong* can not be use as a protein source such as *tempe*, because of the low protein content. It was similar with *tempe gembus*, which was produced from solid by-product of soybean curd factory. People consumed these two fermented products more as snack or side dishes.

**Conclusion**

Eleven species of molds were successfully isolated from different samples. Among the mold isolates three species came out from *kempong* product, i.e. *R. oryzae, E. chevaliery* and *A. oryzae*. The isolates showed the capability in producing amylase, protease, lipase, and cellulase. Both *R. oryzae* and *A. oryzae* indicated as the main fermentation mold in *kempong* production, because the inoculum *laru* only contained these two species.

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