



**ROYAL COATINGS**

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## **Evaluation of PP641 And PP978 Anti-Mold Efficacy in Easy Novo**

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## **SUMMARY:**

The objective of this study was to evaluate the dry film efficacy of PP 641 and PP 978 in Easy Novo

Laboratory testing established the following:

1. Films prepared by combining blank samples Epoxy Base” and “Cure Agent” were susceptible to Mold attack.
2. For a 100% solid based epoxy system, either PP® 641 or PP® 978 will provide dry film mold & Mold protection at 0.60 weight % in the final mixture. This implies an addition rate of 1.2 weight % of either fungicide to the epoxy base of the system.

**BACKGROUND, OBJECTIVE(S):**

Royal Coatings formulates and markets high performance epoxy coatings for extreme conditions such as underwater applications and industrial use. Easy Novo is a two-component epoxy coating that requires a 2:1 mixture of Part A, the epoxy resin base, and Part B, the curing agent. The objective of this study is to evaluate the efficacy of varying levels of PP 641 and PP 978 against mold & Mold attack. The standard testing protocol include 144 hour leaching of the prepared dry films before testing.

**SAMPLE IDENTIFICATION:**

SPNO	SPECIMEN
01	Epoxy Base
02	Curing Agent

**EXPERIMENTAL METHODS:**

Prior to testing with modified ASTM methods, biocide additions were added to sample “Epoxy Base”. The treated samples were then mixed with untreated samples of “Curing Agent” in a 2:1 ratio. The test samples were then analyzed according to the Standard Mold Resistance Test (SOP MI-09) and Standard Algae Resistance Test ( Standard Test 1.3.Alg.1). Microbiology details are presented below.

**RESULTS:**

Films of the blank samples prepared from “Epoxy Base” plus “Curing Agent” were susceptible to mold & Mold attack at all leach times.

Separate additions of 0.6 weight% PP 641 and 0.6 weight% PP 978 to the final dual component system provided adequate resistance to Mold attack after the longest leaching period.

**DISCUSSION, CONCLUSIONS & RECOMMENDATIONS:**

Either PP 641 or PP 978 at 0.60 weight % in the final dual component was sufficient to provide dry film Mold protection at the longest leaching period.

## EXPERIMENTAL METHODS:

### Mold

**Mold Resistance Test:** (SOP MI-09) The samples were tested in accordance with a modified version of ASTM D 5590-00. One coat of each sample was applied to both sides of Whatman #2 filter paper in triplicate and air dried for 24 hours. One part of the coating specimen from each sample was exposed for 72 hours in room temperature tap water with one water exchange every 24 hours and air dried for 24 hours. Another part of the coating specimen from each sample was exposed for 96 hours in room temperature tap water with one water exchange every 24 hours and air dried for 24 hours. Another part of the coating specimen from each sample was exposed for 144 hours in room temperature tap water with one water exchange every 24 hours and air dried for 24 hours. The coating specimens were then cut into 1-inch squares two of which were placed in petri dishes containing solidified Malt Agar and seeded with a combination of *Aspergillus niger* and *Penicillium funiculosum* fungal organisms and two of which were placed in petri dishes containing solidified Malt Agar and seeded with *Aureobasidium pullulans*. All of the squares were then top inoculated with 0.1 ml of the test fungi. The petri dishes were incubated for a period of 3 weeks at 28 °C.

#### Test Organisms:

*Aspergillus niger* (ATCC #6275)

*Aureobasidium pullulans* (ATCC #9348)

*Penicillium funiculosum* (ATCC #11797)

### ALGAE

**Algae Resistance Test:** (Standard Test 1.3.Alg.1) One coat of each sample was applied to both sides of Whatman #2 filter paper in triplicate and air dried for 24 hours. One part of the coating specimen from each sample was exposed for 72 hours in room temperature tap water with one water exchange every 24 hours and air dried for 24 hours. The other parts of the coating specimen from each sample were exposed for 96 and 144 hours in room temperature tap water with one water exchange every 24 hours and air dried for 24 hours. A 0.35 ml suspension of algae was spread over the plate with a “Drigalski” spatula. Two ½ inch squares were cut from each specimen and placed on Proteose agar plates. Algae suspension was placed on top of each filter paper square. The petri dishes were then incubated for two weeks at 15 degrees C, 52% RH and 4000-lux light.

#### Test Organisms:

*Chlorella vulgaris var viridis* (ATCC #16487)

*Chlorella sp.* (Troy Isolate)










*Stichococcus bacillaris* (BIUC #K-150)

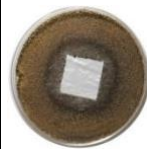

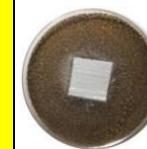






**TABLE I****EVALUATION OF PP 641 AND PP 978  
AGAINST MOLD & MOLD ATTACK**

SAMPLE IDENTIFICATION	MOLD RATING					
	<i>Aureobasidium pullulans</i>			<i>A. niger + P. funiculosum</i>		
	72h Leach	96h Leach	144h Leach	72h Leach	96h Leach	144h Leach
Epoxy Base + Cure Agent	0	0	1	1	2	2
+ 0.6% PP® 641	Z(2)	Z(2)	0	Z(3)	Z(2)	Z(2)
+ 0.8% PP® 641	Z(4)	Z(3)	Z(2)	Z(4)	Z(2)	Z(2)
+ 1.0% PP® 641	Z(5)	Z(3)	Z(3)	Z(4)	Z(4)	Z(2)
+ 1.2% PP® 641	Z(5)	Z(4)	Z(3)	Z(4)	Z(4)	Z(3)
+ 0.6% PP® 978	Z(5)	Z(4)	Z(4)	0	0	0
+ 0.8% PP® 978	Z(6)	Z(6)	Z(5)	0	0	0
+ 1.0% PP® 978	Z(9)	Z(9)	Z(5)	0	0	0
+ 1.2% PP® 978	Z(9)	Z(9)	Z(4)	0	0	0

**TABLE I (Cont.)**

**EVALUATION OF PP® 641 AND PP® 978  
AGAINST MOLD ATTACK**

SAMPLE IDENTIFICATION	MOLD RATING					
	<i>Aureobasidium pullulans</i>					
	72h Leach		96h Leach		144h Leach	
Epoxy Base + Cure Agent)	0		0		1	
+ 0.6% PP® 641	Z(2)		Z(2)		0	
+ 0.6% PP® 978	Z(5)		Z(4)		Z(4)	

SAMPLE IDENTIFICATION	MOLD RATING					
	<i>A. niger + P. funiculosum</i>					
	72h Leach		96h Leach		144h Leach	
Epoxy Base + Cure Agent	1		2		2	
+ 0.6% PP® 641	Z(3)		Z(2)		Z(2)	
+ 0.6% PP® 978	0		0		0	

**LEGEND**



= No Growth



= Trace Growth (<10% coverage )



= Light Growth (10-30% coverage)



= Moderate Growth (30-60% coverage)



= Heavy Growth (60% to complete coverage )