

## PERFORMANCE PRODUCTS

**Redução do formaldeído em aplicações  
automotivas através do uso de  
inibidores de aldeído JEFFADD®**

*Formaldehyde Reduction in Automotive Seating Polyurethane  
Foam through the utilization of JEFFADD® Aldehyde Scavengers*

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Huntsman**

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- **Preocupações Globais com Aldeído**

*Global Aldehyde Concerns*

- **Emissões de Aldeídos: Enunciado do Problema**

*Aldehyde Emissions: Statement of the Problem*

- **Múltiplas Fontes de Emissões**

*Multiple Sources of Emissions*

- **Redução proativa do conteúdo de formaldeído nos catalisadores de amina JEFFCAT®**

*Proactively reducing the formaldehyde content in JEFFCAT® Amine Catalysts*

- **Introdução de Inibidores de Aldeído JEFFADD® e redução de formaldeído em espuma de poliuretano**

*Introduction of JEFFADD® Aldehyde Scavengers and formaldehyde reduction in polyurethane foam*

# Preocupações Globais com Aldeído

## *Global Aldehyde Concerns*

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- Ênfase global para reduzir o teor de aldeído na espuma de poliuretano

*Global emphasis to reduce the aldehyde content in polyurethane foam*



- Diferentes regiões estão se concentrando em moléculas específicas de aldeídos

*Different regions are focusing on specific aldehyde molecules*



- Indústria automotiva é o principal foco de redução de aldeídos

*Automotive industry is the main focus for aldehyde reduction*



- Colaboração entre Fabricantes de Espuma de Poliuretano e Fornecedores de Matérias-Primas

*Collaboration between Polyurethane Foam Manufacturers and Raw Material Suppliers*



# Emissões de Aldeídos: Enunciado do Problema

## *Aldehyde Emissions: Statement of the Problem*

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- **Clientes e consumidores estão preocupados com as emissões de certos produtos químicos e odor na espuma de poliuretano**

*Customers and consumers are concerned about emissions of certain chemicals and odor in the polyurethane foam*



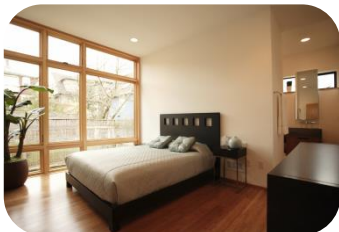
- **Para as indústrias colchoeira e moveleira, Dimetilformamida (DMF) é uma preocupação**

*For the bedding and furniture industries, Dimethylformamide (DMF) is a concern*



- **Acreditamos que o formaldeído e o DMF podem estar relacionados entre si**

*We believe the formaldehyde and DMF may be related to each other*



- **Parte do odor pode estar relacionada a aldeídos, uma vez que estes têm odores únicos**

*Part of the odor may be related to aldehydes, since various aldehydes have unique odors*

## Regras Gerais

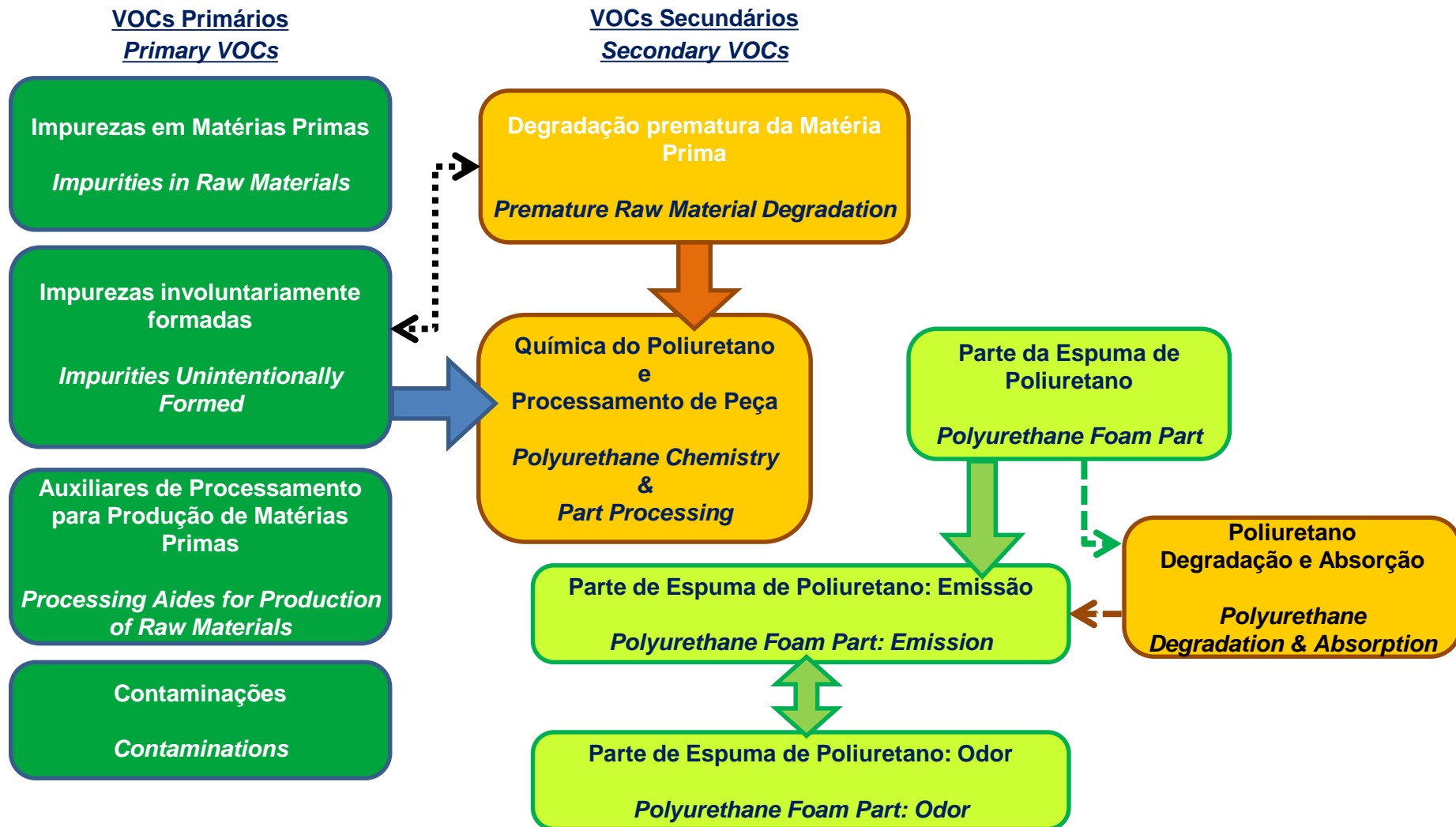
### General Rules

- **Qualquer catalisador de amina que tenha um grupo dimetilamina e seja exposto ao ar, irá acumular baixos níveis de formaldeído e DMF**  
*Any amine catalyst that has a dimethyl amine group and exposed to air, will build-up low levels of formaldehyde and DMF*
- **Eliminação do oxigênio, retarda o acúmulo de DMF e formaldeído**  
*Elimination of the oxygen, slows down the build-up of DMF and formaldehyde*
- **Geralmente, as amostras de catalisador de amina amarelada são uma boa indicação de que os aldeídos estão presentes**  
*Generally, yellow amine catalyst samples are good indication that aldehydes are present*
- **No entanto, as amostras de catalisador de amina incolor podem apresentar baixos níveis de aldeídos**  
*However, water white amine catalyst samples may have low levels of aldehydes*



# Múltiplas Fontes de Emissões

## Multiple Sources of Emissions



### Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

#### *Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst*

- 100 gramas de catalisador de amina foram introduzidos em um frasco de amostra, com e sem um aditivo

*100 grams of amine catalyst was introduced into a sample bottle, with and without an additive*

- O espaço do frasco foi preenchido com ar ou nitrogênio e selado

*The head space was padded with either air or nitrogen and sealed*

- Os recipientes de amostra foram armazenadas a temperatura ambiente e a 60°C por um período de tempo especificado

*The sample bottles were stored at ambient and 60°C temperatures for a specified time period*

- As amostras foram extraídas e analisadas quanto ao conteúdo de formaldeído via Cromatografia Líquida

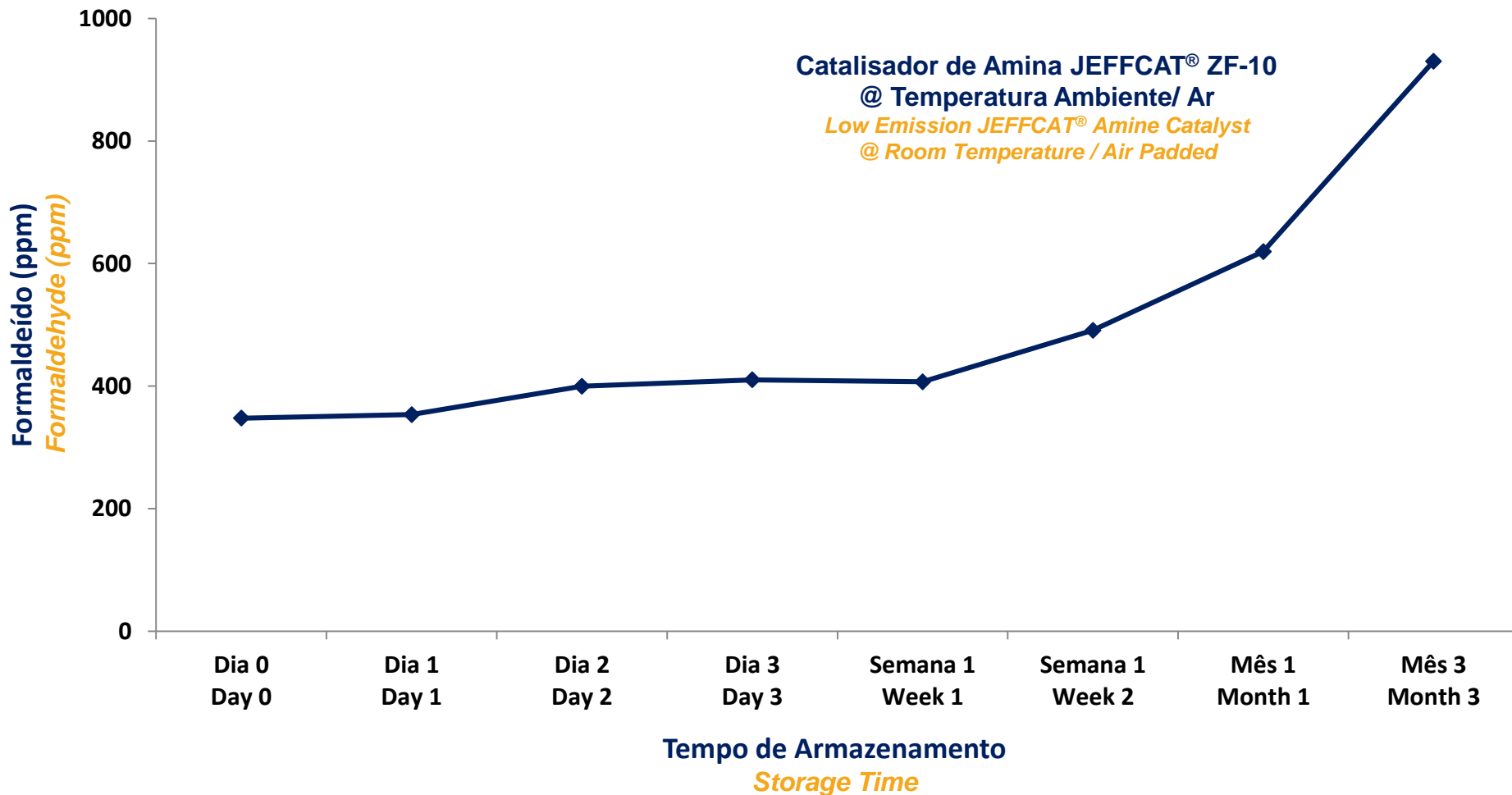
*Samples were extracted and analyzed for the formaldehyde content via Liquid Chromatography*

# Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

*Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst*

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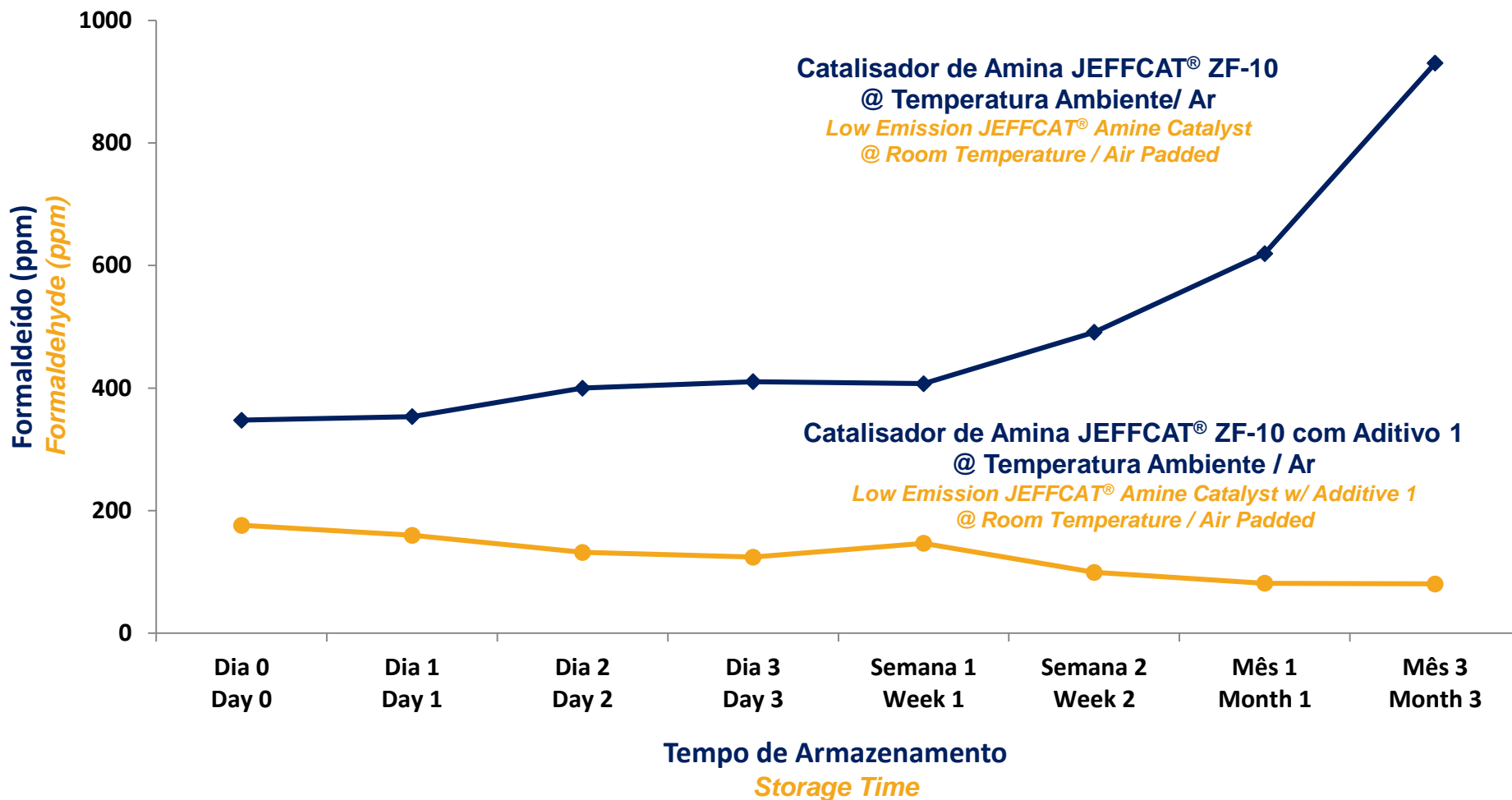


# Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst

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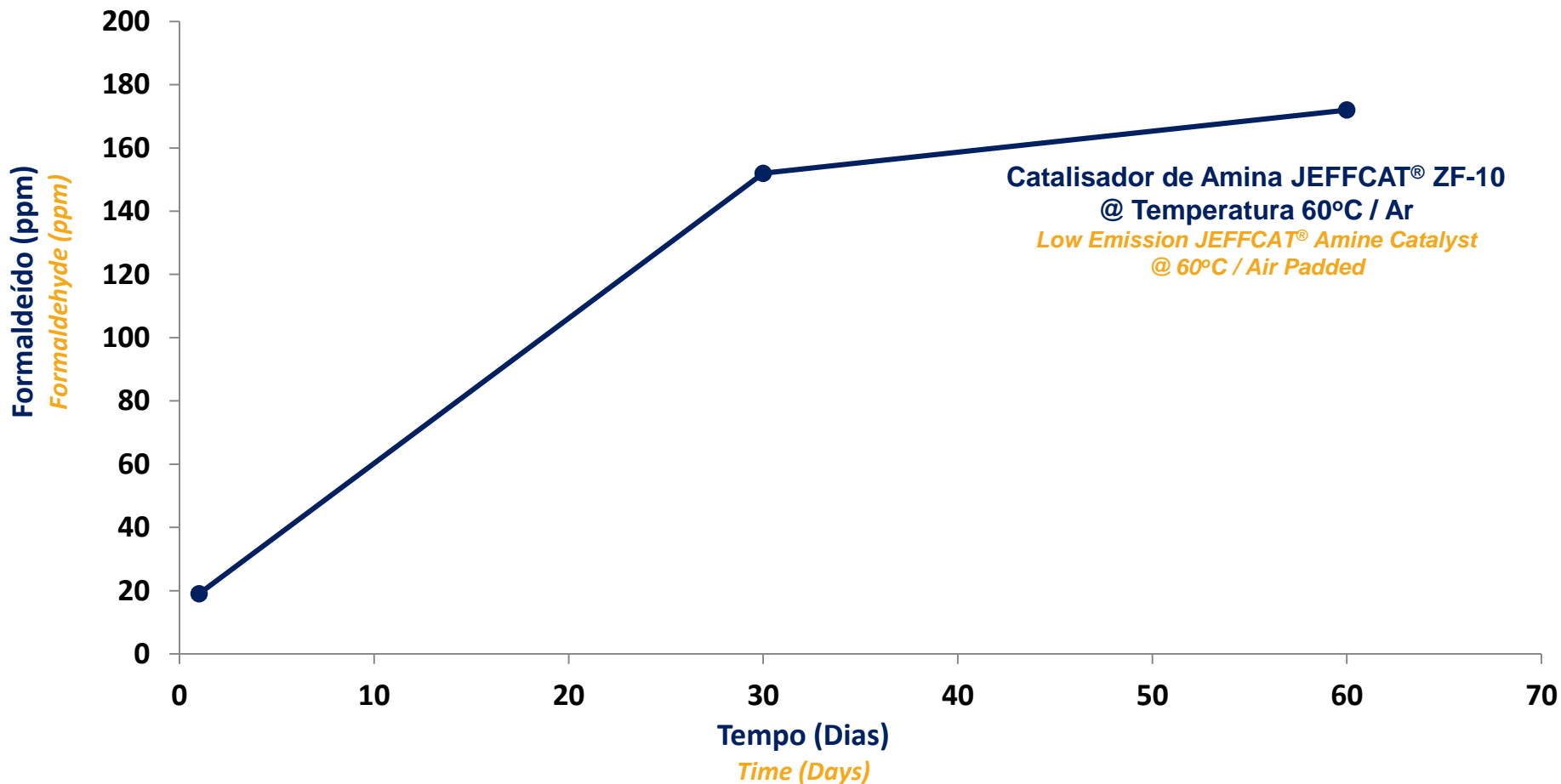


# Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

*Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst*

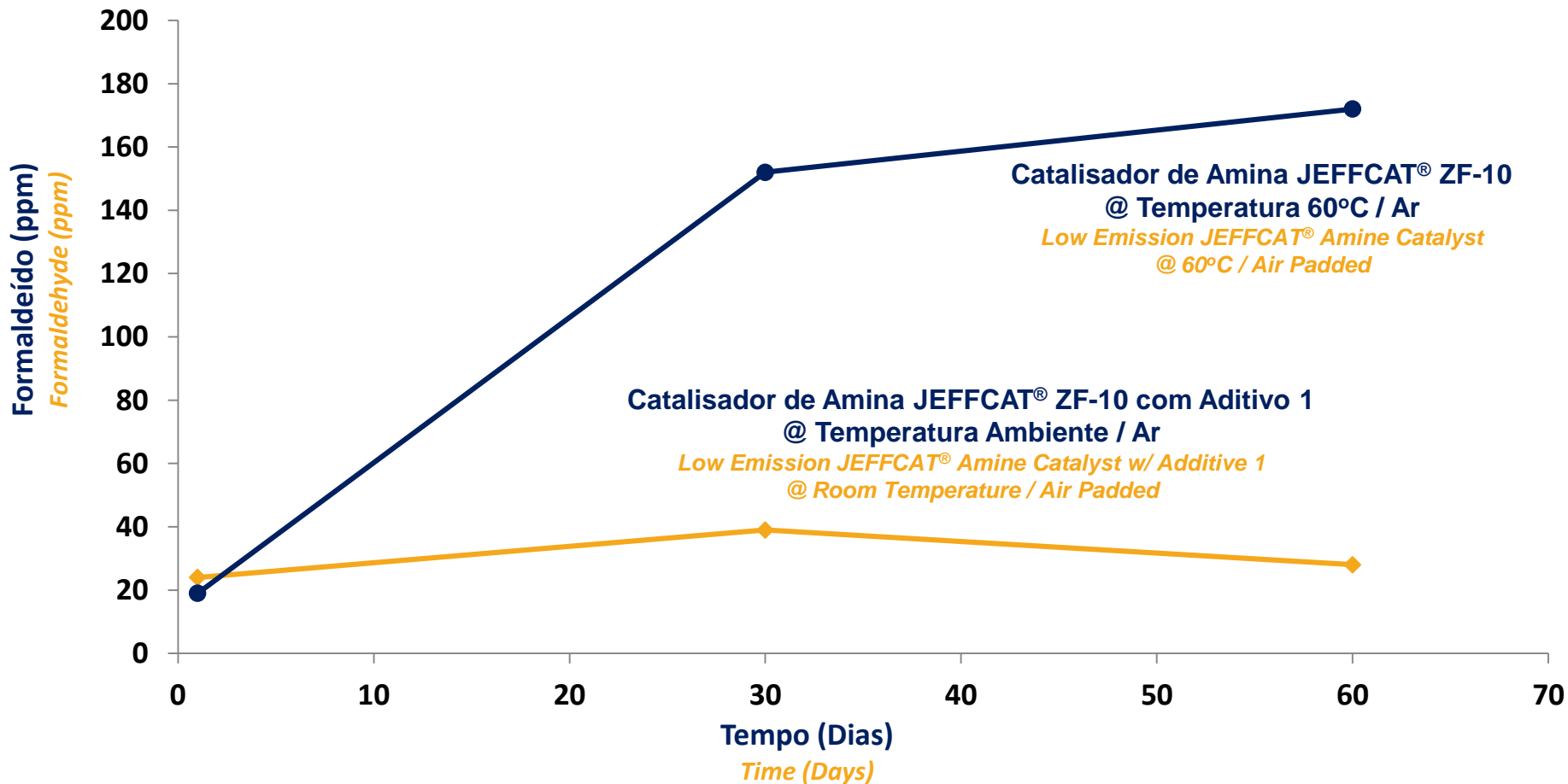
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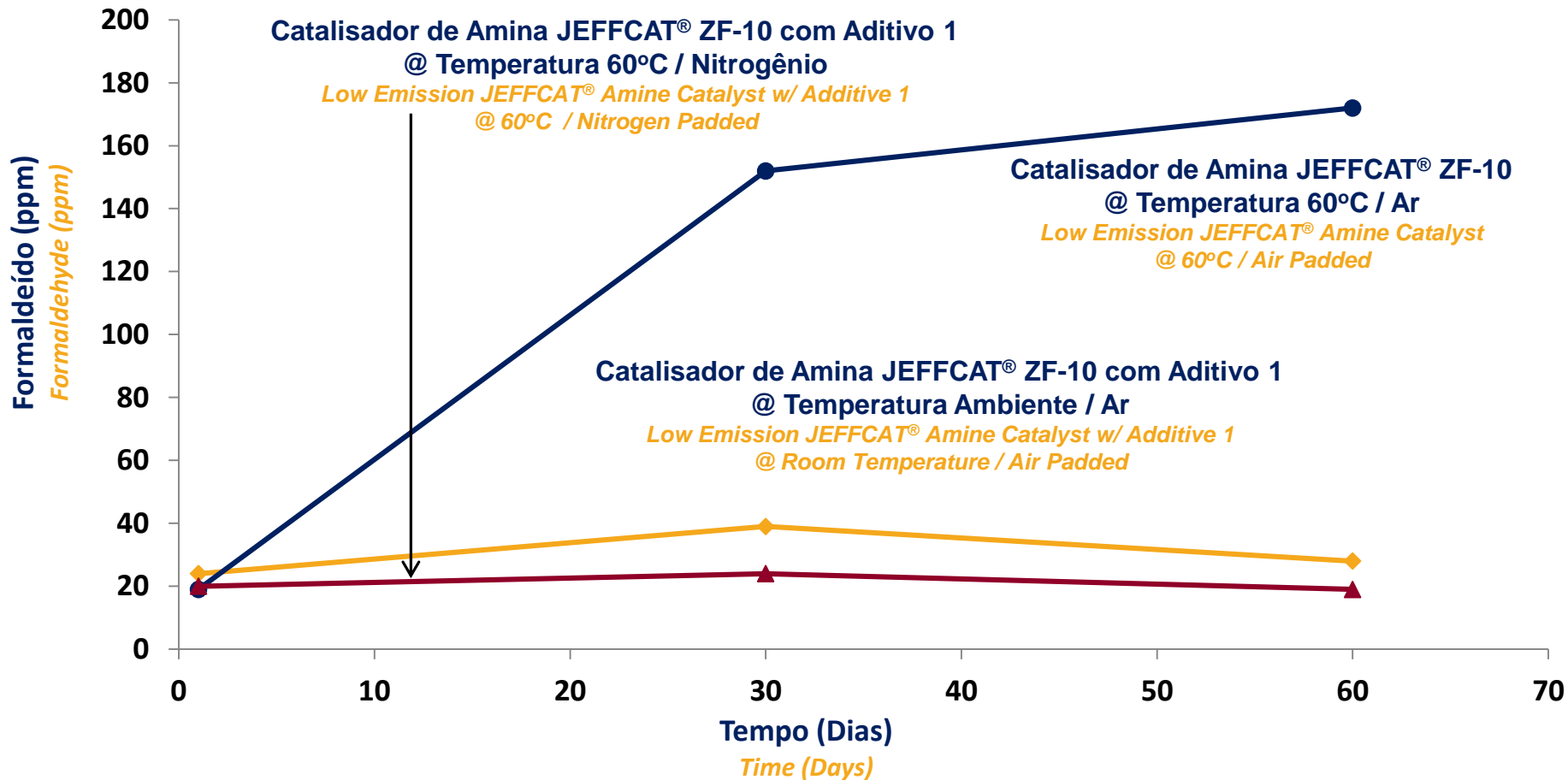
# Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

*Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst*



# Teor de Formaldeído em um Catalisador de Amina JEFFCAT® de Baixa Emissão

Formaldehyde content in a Low Emission JEFFCAT® Amine Catalyst



## Resumo do conteúdo de Formaldeído em Catalisador de Aminas de Baixa Emissão

### *Summary of Formaldehyde content in Low Emission Amine Catalyst*

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- Preenchendo o espaço do frasco com o ar, irá causar um aumento de formaldeído ao longo do tempo

*Padding the head space with air, will cause an increase in formaldehyde over time*



- Os aditivo 1 ajudou a reduzir o teor de formaldeído no catalisador de amina

*Additive 1 helped reduce the formaldehyde content in the amine catalyst*



- Aumentar a temperatura de armazenamento acelera a formação de formaldeído

*Increasing the storage temperature accelerates the formaldehyde formation*



- O acúmulo de nitrogênio no espaço do frasco ajuda a reduzir a formação de formaldeído

*Nitrogen padding the head space helps reduce the formation of formaldehyde*

### Teor de Formaldeído em Espuma de Poliuretano

#### *Formaldehyde content in Polyurethane Foam*

- **Espuma de poliuretano de baixa emissão foi fabricada**  
*Low emission polyurethane foam was manufactured*
- **Um pequeno pedaço de espuma de poliuretano foi extraído e colocado em um instrumento de micro-câmara**  
*A small piece of polyurethane foam was extracted and placed in a micro chamber instrument*
- **Amostra de espuma de poliuretano foi aquecida a 65°C por 3 horas, sob purga de ar, e o ar foi coletado em um cartucho de dinitrofenilhidrazina (DNPH)**  
*Polyurethane foam sample was heated to 65°C for 3 hours, under air purging, and the air was collected in a Dinitrophenylhydrazine (DNPH) cartridge*
- **O cartucho DNPH foi submetido a testes de Cromatografia Líquida**  
*The DNPH cartridge was submitted for Liquid Chromatography testing*
- **O procedimento de teste foi repetido para avaliar os inibidores de aldeído**  
*Test procedure was repeated to evaluate the aldehyde scavengers*

# Dados de Emissão de Formaldeído de Espuma de Poliuretano

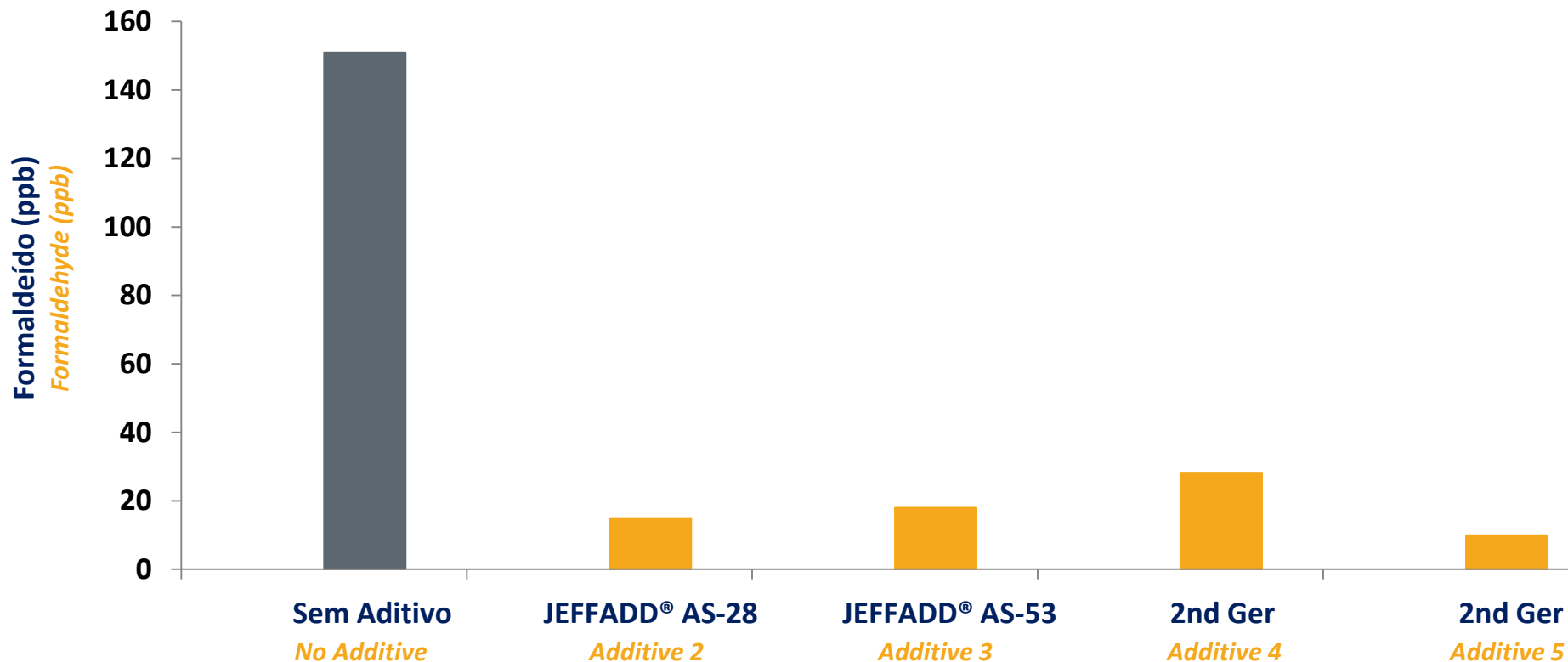
*Polyurethane Foam Formaldehyde Emission Data*

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## Emissões de Formaldeído de Espuma de Poliuretano a 65°C (Método VDA-276)

*Formaldehyde Emissions from Polyurethane Foam at 65°C (VDA-276 Method)*



**Inibidores de Aldeído JEFFADD®**

*JEFFADD® Aldehyde Scavengers*

•Espumas de poliuretano produzidas sem um inibidor de aldeído geram altos níveis de formaldeído

*Polyurethane foams produced without an aldehyde scavenger will generate high levels of formaldehyde content*

•Os Inibidores de Aldeído JEFFADD® AS-28, AS-53 e produtos da 2° Geração ajudaram a reduzir o conteúdo de formaldeído no produto final de espuma de poliuretano

*Aldehyde Scavengers 2, 3, 4 and 5 all helped to reduce the formaldehyde content in the final polyurethane foam product*

•É importante lembrar que, embora o teor de formaldeído tenha sido reduzido, o processo de espuma de poliuretano pode ser afetado e deve ser considerado.

*It is important to remember that although the formaldehyde content was reduced, the polyurethane foam process may be affected and should be considered.*



• **Descrição da Preocupação Global pelos Aldeídos, o Enunciado do Problema e algumas Regras Gerais**

*Described the Global Concern for Aldehydes, the Problem Statement and some General Rules*

• **Apresentação das fontes potenciais de emissões dentro de todo o processo de fabricação de poliuretano, incluindo matérias-primas**

*Presented the potential sources of emissions within the entire polyurethane manufacturing process, including raw materials*

• **Demonstração da redução de formaldeído no catalisador amina, em diferentes condições de armazenamento, utilizando diferentes aditivos**

*Demonstrated the reduction of formaldehyde in the amine catalyst, at different storage conditions, utilizing different additives*

• **Demonstração da vantagem de utilizar o Inibidor de Aldeído JEFFADD® em espuma de poliuretano moldada com alta resiliência baseada em MDI**

*Demonstrated the advantage of utilizing JEFFADD® Aldehyde Scavengers in MDI based High Resiliency molded polyurethane foam*

# Obrigado

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**[www.huntsman.com/performance\\_products](http://www.huntsman.com/performance_products)**

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