BERACA

RAIN FOREST 05910 (REFINED PEQUI OIL)

RAIN FOREST
SPECIALTIES
BRASIL

BERACA

BERACA presents a wide porfolio composed of fixed oils, butters, scrubs, clays and actives sustainably sourced from the Brazilian biodiversity. The ingredients come from extractive communities throughout Brazil and are manufactured to connect our biodiversity with thousands of consumers around the world. Through a relationship marked by transparency, traceability and innovation, Beraca contributes directly to regional development and environmental preservation.

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GENERAL INFORMATION

Product Code: BR05910B

Related codes: BR05910BA00, BR05910BB46, BR05910BD19, BR05910BX15, BR05910BX18, BR05910BX36, BR05910BX45

Previous code: RF5910

Pequi *(Caryocar brasiliense)* is found throughout the Brazilian cerrado, known as the Brazilian savanna, with great natural plantations in the states of Maranhão, Piauí, Pará, Mato Grosso, Goiás, Minas Gerais and Tocantins (RIBEIRO, 2000). These findings emphasize the economic and cultural importance of the fruit of "pequizeiro" for the population of cerrado, especially for those working with the extractive sector. It is used mainly in regional cuisine and in different ways. Therefore, it is also known as "cerrado's gold".

As for the morphological, the "*pequizeiro*" reaches between 8 and 12m high (EMBRAPA, 2009). Its trunk has an average circumference of 2.5m. It is a perennial plant and its flowering occurs from September to November, with fruit ripening in mid-November being found through the month of February (Almeida et al., 1998).

Pequi fruit is a drupe up to 10cm diameter, green, with an average weight of 104.4g, containing one to five seeds with an average weight of 14.2g, coated by woody endocarp with thorns and yellow fleshy mesocarp (CARVALHO et al., 1996). It is constituted, approximately, of 84% peel, 10% pulp, and 6% seed (Embrapa, 2008). The pulp is rich in oil constituent (61.7%) and almond (12.2%) (FERREIRA et al., 1987).

COSMETIC USE

Pequi oil is rich in fatty acids, in greater quantity oleic and palmitic. These fatty acids are very similar to those found in the epidermis. The presence of these fatty acids allows the use of this oil in cosmetic formulations for skin and hair.

EFFICACY EVALUATION

HAIR CARE

INTRODUCTION

Hair is one of the body parts that have been receiving the attention of Brazilians. We observed many applied investments, particularly by women, to modify texture, color, cut, among other interventions that can bring these consumers to feel good about themselves (SIMÕES, et al., 2010).

According to data from Euromonitor, from 2009 until today Brazil ranks third in consumption of health and beauty products, only behind the US and China. Among the items that lead the Brazilian market, hair products rank first, followed by perfumes and skin cosmetics. Treatments that promise to define and treat curls are among the favorites.

In Brazil, according to a survey carried out by *Instituto U&A HairCare* and commissioned by the L'Oreal Group, 48 million Brazilian women have naturally curly hair, which represents 54% of the country's female population. Given these data, the purpose of Beraca was to seek a solution in nature for curly hair care, for frizz-free defined curls.

Curly hair tends to be drier because of its spiral-shaped format, making it more difficult to hydrate, and therefore require a lot of attention. As this type of hair is usually voluminous, it needs constant hydration to make them shinier, silkier and with less volume. Experts recommend combing the curls while they are still damp to maintain its structure intact, untangling them carefully, always from root to ends.

This way, to facilitate combing curly hair and to keep them hydrated and defined even when dried, Beraca presents RAIN FOREST 05910 (REFINED PEQUI OIL) as a hair product with proven efficacy to define the curls and reduce frizz.

PURPOSE

The purpose of this study was to evaluate by image assessment **curl definition** and **frizz reduction** in hair shafts subjected to treatments with REFINED PEQUI OIL.

METHODS

1. Laboratory

The study was performed in an independent laboratory, *Kosmoscience Ciência & Tecnologia Cosmética Ltda*. Study reference: RE-BC041-16-R0.

2. Experimental Groups and Treatments

Experimental groups and respective treatments are shown in the table below (Table 1).

Table 1. Products used in the study protocol.

Experimental Group	Treatment
PLACEBO	Emulsion with REFINED PEQUI OIL
REFINED PEQUI OIL 1.5%	Emulsion with REFINED PEQUI OIL at 1.5%
REFINED PEQUI OIL 3.0%	Emulsion with REFINED PEQUI OIL at 3.0%

The products were stored at room temperature for the duration of the study.

Formulations of the products used for the treatments are shown below.

3. Formulations of the products used

3.1. Placebo

Formulation:	PLACEBO

INGREDIENTS	INCI	%	SUPPLIER
PHASE A			
WATER	*Aqua*	Up to 100%	–
EDTA	*Dissodium EDTA*	0.10	–
PHASE A1			
ARISTOFLEX AVC	*Ammonium Acryloyldimethyltaurate/VP Copolymer*	2.50	–
PHASE B			
PHENOXYETHANOL	*Phenoxyethanol*	0.65	–

Procedure:

Weigh the ingredients from PHASE A. Disperse PHASE A1 and wait until the polymer is completely hydrated. Homogenize until a gel is formed.
Add to PHASE B whilst stirring.

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3.2. 1.5% REFINED PEQUI OIL Emulsion

Formulation:	1.5% REFINED PEQUI OIL EMULSION

INGREDIENTS	INCI	%	SUPPLIER
PHASE A			
WATER	*Aqua*	Up to 100%	–
EDTA	*Dissodium EDTA*	0.10	–
PHASE A1			
ARISTOFLEX AVC	*Ammonium Acryloyldimethyltaurate /VP Copolymer*	2.50	–
PHASE B			
BR05910B RAIN FOREST 05910 (REFINED PEQUI OIL)	***Caryocar brasiliense fruit oil, Tocopherol***	**1.50**	**BERACA**
PHASE C			
PHENOXYETHANOL	*Phenoxyethanol*	0.65	-

Procedure:

Weigh the ingredients from PHASE A. Disperse PHASE A1 and wait until the polymer is completely hydrated. Homogenize until a gel is formed.
Add PHASES B and C whilst stirring.

3.3. 3.0% REFINED PEQUI OIL Emulsion

Formulation:	3.0% REFINED PEQUI OIL EMULSION

INGREDIENTS	INCI	%	SUPPLIER
PHASE A			
WATER	*Aqua*	Up to 100%	–
EDTA	*Dissodium EDTA*	0.10	–
PHASE A1			
ARISTOFLEX AVC	*Ammonium Acryloyldimethyltaurate /VP Copolymer*	2.50	–
PHASE B			
BR05910B RAIN FOREST 05910 (REFINED PEQUI OIL)	***Caryocar brasiliense fruit oil, Tocopherol***	**3.00**	**BERACA**
PHASE C			
PHENOXYETHANOL	*Phenoxyethanol*	0.65	-

Procedure:
Weigh the ingredients from PHASE A. Disperse PHASE A1 and wait until the polymer is completely hydrated.
Homogenize until a gel is formed.
Add PHASES B e C whilst stirring.

4. Procedure

4.1 Preparation of the hair shafts

Fifteen 25 cm hair shafts of naturally curled Caucasian weighing 5.0 g were prepared. All hair shafts were subjected to a standard pre-cleaning process using a 10% Sodium Lauryl Ether Sulphate (SLES) solution for 1 minute rinsing with running water.

4.2 Treatment Protocol

The protocol was carried out in a refrigerated environment with controlled and steady temperature (22 ± 2°C) and relative humidity (55 ± 5%) during the treatment.

a) Water used for the rinsing was between 35-40 °C;
b) The hair shafts were rinsed for 20s, followed by removal of excess water;
c) 1.0 mL SLES solution was applied to each lock of hair, which were then massaged for 60s. The hair shafts were rinsed for 30s and excess water was removed. This process was carried out two consecutive times
d) 0.5 mL of the test product was applied to each lock of hair and massaged for 60s. The hair shafts were left to dry naturally (without combing or brushing) for 24h, without rinsing.
e) Digital images of all air shafts were made immediately after test product application and after 24h of the treatment;

4.3 Image analysis

The original images, all with a 6.0 Mpixels resolution, were converted to gray scale using the software Scion® Image for Windows (ScionCorp). Software analyses were performed for these images to determine the curl definition and frizz reduction action.

RESULTS

1. Curl Definition

The curl definition parameter, ***DC***, was determined according to frizz and strand volume results (equation 1).

$$DC\ (\%) = 100 - Frizz - Volume$$

Equation 1. Calculation of Curl Definition parameter from values obtained in the frizz and volume analysis.

Frizz is determined as the percentage in areas of black pixels referent to frizzy hair (loose from the body of the hair strand), obtained from digital images after binarization (black/white conversion).

Volume is determined as the percentage in areas of black pixels referent to the body of the hair strand, obtained from digital images after binarization.

Chart 1 shows values calculated for ***DC***. Complete results are shown in Table 4.

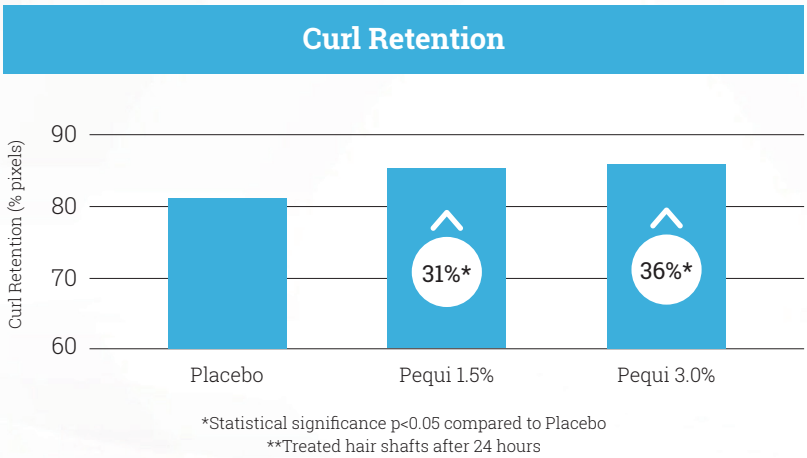

Chart 1. Curl definition values for the study groups.

Final ***DC*** data obtained for the treatments with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** where analyzed statistically in comparison with the **Placebo** group using the single factor analysis of variances method, followed by a Dunnet test of multiple comparisons, considering a confidence interval of 95%. Final DC values obtained for the study groups **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** were statistically compared using bimodal, non-paired Student's t-Test with a confidence interval of 95%. According to the results obtained, hair shafts subjected to treatment with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** showed significantly higher Curl Definition results compared to the **Placebo** group (figure 2).

No statistically significant difference was observed between treatments with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** for ***DC*** values.

Table 2 shows "Curl Definition Variation, V_{DC}", by percentage and number of times, calculated in relation to the **Placebo** group, according to equations 2 and 3.

$$\%V_{DC} = 100* \left(\frac{DC_f^{EXP} - DC_f^{PLA}}{DC_i^{EXP} - DC_f^{PLA}} \right)$$

Equation 2. Calculation of Curl Definition Variation (%) in the treatment groups in relation to the **Placebo** *group*, where: DC^{PLA} **=** ***DC*** values for the ***Placebo*** *group*; DC^{EXP} **=** ***DC*** values for the **experimental group**; ***i*** = initial e ***f*** = final.

$$V_{DC} = \frac{DC_f^{EXP}}{DC_f^{PLA}}$$

Equation 3. Calculation of Curl Definition Variation (by number of times), where: DC^{PLA} = ***DC*** values for the ***Placebo*** *group*; DC^{EXP} = ***DC*** values for the **experimental group** and ***f*** = final.

Table 2. Curl Definition variation in relation to the **Placebo** group 24h after of test product application.

Experimental Group	% in relation to Placebo	Number of times in relation to Placebo
REFINED PEQUI OIL 1.5%	31	1.1
REFINED PEQUI OIL 3.0%	36	1.1

2. Frizz Reduction

Chart 2 shows the Frizz Reduction results. Complete results are listed in Table 4.

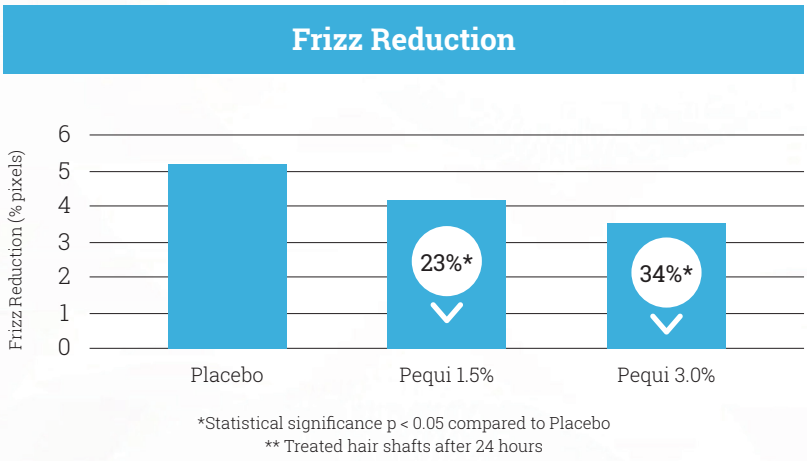

Chart 2. Frizz reduction values for the study groups.

The final *frizz* reduction values obtained for the groups **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** were statistically compared to the final values obtained for the **Placebo** group using the single factor analysis of variances method, followed by a Dunnet test of multiple comparisons, considering a confidence interval of 95%. Final frizz reduction values obtained for the study groups **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** were statistically compared using bimodal, non-paired Student's t-Test with a confidence interval of 95%

After 24h in controlled environment, the hair shafts subjected to treatments with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** showed significantly lower results compared to the **Placebo** treatment (figure 2).

No statistically significant difference was observed between treatments with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** for frizz values.

Table 3 shows "Frizz Reduction, ***RF***", by percentage and number of times, calculated in relation to the **Placebo** group, according to equations 4 and 5.

$$RF = 100* \left(\frac{RF_f^{EXP} - RF_f^{PLA}}{RF_i^{EXP} - RF_f^{PLA}} \right)$$

Equation 4. Calculation of Frizz reduction (%) in the treatment groups in relation to the ***Placebo*** group, where: RF^{PLA} = ***RF*** values for the ***Placebo*** *group*; RF^{EXP} = ***RF*** values for the **experimental group**; ***i*** = initial and ***f*** = final.

$$RF = \frac{RF_f^{PLA}}{RF_f^{EXP}}$$

Equation 5. Calculation of Frizz reduction (by number of times) in the treatment groups in relation to the ***Placebo*** group, where: RF^{PLA} = ***RF*** values for the ***Placebo*** *group*; RF^{EXP} = ***RF*** values for the **experimental group** and ***f*** = final.

Table 3. Frizz reduction in the treatment groups in relation to **placebo**.

Experimental Group	% in relation to Placebo	Number of times in relation to Placebo
REFINED PEQUI OIL 1.5%	23	1.3
REFINED PEQUI OIL 3.0%	34	1.5

*Treated hair shafts after 24 hours

Figure 2. Images of treated hair shafts with the experimental groups.

3. Result Overview

All the results are presented in Table 4.

Table 4. Overview of results from the study with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** in relation to curl definition and frizz reduction.

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	Curl Definition (%)					
	Initial			Final		
	PLACEBO	REFINED PEQUI OIL 1.5%	REFINED PEQUI OIL 3.0%	PLACEBO	REFINED PEQUI OIL 1.5%	REFINED PEQUI OIL 3.0%
	94.95	95.21	94.06	82.45	87.37	86.21
	93.17	95.15	95.53	81.55	86.88	84.91
	95.86	94.39	94.36	84.17	84.23	88.45
	94.84	94.29	93.90	80.28	84.17	86.12
	93.91	93.77	93.80	77.92	84.26	84.21
Mean	**94.55**	**94.56**	**94.33**	**81.27**	**85.38**	**85.98**
SD	**1.034**	**0.612**	**0.703**	**2.350**	**1.601**	**1.616**

	Frizz Reduction (%)					
	Initial			Final		
	PLACEBO	REFINED PEQUI OIL 1.5%	REFINED PEQUI OIL 3.0%	PLACEBO	REFINED PEQUI OIL 1.5%	REFINED PEQUI OIL 3.0%
	0.52	0.50	0.46	5.34	3.61	3.17
	0.60	0.41	0.64	4.70	3.91	4.13
	0.70	0.51	0.51	4.40	4.49	2.93
	0.60	0.55	0.43	5.19	4.35	3.36
	0.63	0.55	0.56	6.60	4.51	4.49
Mean	**0.61**	**0.50**	**0.52**	**5.25**	**4.17**	**3.62**
SD	**0.065**	**0.057**	**0.083**	**0.845**	**0.397**	**0.664**

CONCLUSION

1. Curl Definition

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 1.5%** presented curl definition **31%** (1.1 times) higher in relation to hair shafts from the **Placebo** group.

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 3.0%** presented curl definition **36%** (1.1 times) higher in relation to hair shafts from the **Placebo** group.

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** presented no significant differences in curl definition values when compared with one another.

2. Frizz Reduction

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 1.5%** presented frizz reduction **23%** (1.3 times) higher in relation to hair shafts from the **Placebo** group.

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 3.0%** presented frizz reduction **34%** (1.5 times) higher in relation to hair shafts from the **Placebo** group.

Hair shafts subjected to treatment with **REFINED PEQUI OIL at 1.5%** and **REFINED PEQUI OIL at 3.0%** presented no significant differences in frizz reduction values when compared with one another.

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APPLICATION

FORMULA SUGGESTIONS

1. Finishing Oil

Formulation:	**INTENSE CURL OIL**

INGREDIENTS	**INCI**	**%**	**SUPPLIER**
PHASE A			
DERMOFEEL SENSOLV	*Isoamyl Laurate*	Up to 100%	–
BR05910B RAIN FOREST 05910 (REFINED PEQUI OIL)	***Caryocar brasiliense fruit oil, Tocopherol***	**6.00**	**BERACA**
MCT	*Caprylic/Capric Triglyceride*	5.50	–
BA05110B BERACARE BBA (BIO BEHENIC OIL)	***Pentaclethra macroloba seed oil, Tocopherol***	**5.00**	**BERACA**
BR03710B RAIN FOREST 03710 (REFINED MURUMURU BUTTER)	***Astrocaryum murumuru seed butter,Tocopherol***	**5.00**	**BERACA**
BA34310B BERACARE ARS HAIR SYSTEM (HAIR REVITALIZATION OIL)	***Passiflora edulis seed oil (e) Oriza sativa rice bran oil (e) Euterpe oleracea fruit oil***	**3.00**	**BERACA**
PHASE B			
DERMOFEEL TOCO 70 NON-GMO	*Tocopherol, Helianthus Annuus (Sunflower) Seed Oil*	0.50	–
FRAGRANCE	*Fragrance*	0.50	–

Procedure:

Weight the ingredients from PHASE A and heat to 75°C - 80°C.

Start cooling whilst stirring moderately.

Add PHASE B below 30°C.

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2. Curl Defining Balm

Formulation:	KEEP IT CURLY

INGREDIENTS	INCI	%	SUPPLIER
PHASE A			
PLANTASENS VP 170	*Ricinus Communis (castor) seed oil (and) Hydrogenated castor oil (and) Copernicia carifera (carnauba) wax (and) Cera alba (beeswax)*	20.00	–
PLANTASENS OLIVE LD	*Hydrogenated ethylhexyl olivate (and) Hydrogenated olive oil unsaponifiables*	40.00	–
PLANTASENS ABYSSINIAN OIL	*Crambe abyssinica seed oil*	24.40	–
BR04010B	***Orbignya olifera seed oil, Tocopherol***	**1.00**	**BERACA**
RAIN FOREST 04010 (REFINED BABAÇU OIL)	***Caryocar brasiliense fruit oil, Tocopherol***	**3.00**	**BERACA**
BR03510B RAIN FOREST 03510 (REFINED PASSION FRUIT OIL)	***Passiflora edulis seed oil, Tocopherol***	**0.50**	**BERACA**
BEESWAX	*Cera alba (beeswax)*	10.00	–
PHASE B			
PLANTASENS NATURAL VITAMIN E	*Tocopherol*	0.50	–
LEMON ESSENTIAL OIL	*Perfume*	0.10	–

Procedure:
Weight the ingredients from PHASE A and heat to 70°C.
When the mixture has an even consistency, add PHASE B.

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PHYSICAL-CHEMICAL INFORMATION

ANALYSIS	UNITS	SPECIFICATIONS
Appearance (above 32°C)	Visual	Viscous liquid
Appearance (below 32°C)	Visual	Semi-solid, under storage
Color	Visual	Light yellow to orange
Odor	–	Characteristic
Acid value (as oleic acid)	%	≤ 2.0
Peroxide value	$meqO_2/Kg$	≤ 10.0
Iodine value	$gI_2/100g$	25 – 65
Saponification value	mgKOH/g	185 – 225

FATTY ACID COMPOSITION

Palmitic acid (C16:0)	%	25.0 – 55.0
Palmitoleic acid (16:1)	%	≤ 6.0
Stearic acid (C18:0)	%	≤ 3.0
Oleic acid (C18:1)	%	35.0 – 65.0
Linoleic acid (C18:2)	%	0.5 – 10.0
Linolenic acid (C18:3)	%	≤ 2.0

MICROBIOLOGICAL ANALYSIS

Total bacteria h. m.	cfu/g	< 100
Fungus and yeasts	cfu/g	< 100

STORAGE INFORMATION

- **Shelf-Life** → 18 months
- **Conditions** → Dry, cool, airy place, away from light and heat and other sources in an environment with constant temperature not exceeding 25° C
- **Container** → Nitrogen blanketed

IMPORTANT OBSERVATIONS

- Considering that is a natural product, if the storage guidelines are not met, the physicochemical characteristics may vary, reducing the shelf life.
- After opening the product should be consumed as soon as possible. Contact with oxygen generates an oxidative process decreasing the shelf-life of the product.
- Due to the particularity of each oil, it is not possible to establish an oxidative parameter for the period of exposure.
- Natural oil substances and waxes could settle during storage and develop a slight sedimentation at the bottom of the container. Please have this in mind when emptying the container.
- The above information has been developed with the methods and practices set out in AOCS (American Oil Chemists' Society).

REGULATORY INFORMATION

INCI Name (CTFA)	CAS Number
CARYOCAR BRASILIENSE FRUIT OIL	394238-03-0
TOCOPHEROL	59-02-9, 16698-35-4, 54-28-4, 119-13-1

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