In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import scipy as sc
from scipy.stats import linregress
```

In [4]:

```
df = pd.read_csv("task2.csv", sep=";")
df = df[df.index > 0]
df
```

Out[4]:

	Name	УПАВ	Vвода	C	sigma	h	h1	h2	h3	h4	h6
1	1	1.0	29.0	0.006667	68.070860	3632.083333	3637	3612	3654	3616	3627
2	2	1.5	28.5	0.010000	66.132672	3528.666667	3532	3538	3537	3511	3509
3	3	2.0	28.0	0.013333	63.802473	3404.333333	3405	3396	3402	3419	3378
4	4	2.5	27.5	0.016667	61.430106	3277.750000	3270	3271	3276	3277	3269
5	5	3.5	26.5	0.023333	58.573582	3125.333333	3119	3154	3152	3104	3102
6	6	5.0	25.0	0.033333	54.533216	2909.750000	2907	2910	2905	2904	2924
7	7	7.5	22.5	0.050000	49.230920	2626.833333	2631	2634	2628	2630	2633
8	8	10.0	20.0	0.066667	44.451826	2371.833333	2384	2383	2393	2337	2359
9	9	15.0	15.0	0.100000	38.442036	2051.166667	2064	2036	2084	2030	2069
10	10	20.0	10.0	0.133333	34.560974	1844.083333	1844	1836	1850	1876	1831
11	11	30.0	0.0	0.200000	28.874477	1540.666667	1531	1527	1523	1546	1542
12	6У	5.0	25.0	0.033333	61.003735	3255.000000	3238	3231	3268	3233	3246
13	7У	7.5	22.5	0.050000	53.026084	2829.333333	2800	2823	2833	2836	2830
14	8У	10.0	20.0	0.066667	52.582534	2805.666667	2774	2805	2776	2802	2805
15	9У	15.0	15.0	0.100000	47.070957	2511.583333	2520	2516	2521	2536	2522
16	10У	20.0	10.0	0.133333	42.265312	2255.166667	2238	2291	2242	2230	2279
17	11У	30.0	0.0	0.200000	42.195031	2251.416667	2242	2240	2233	2246	2244

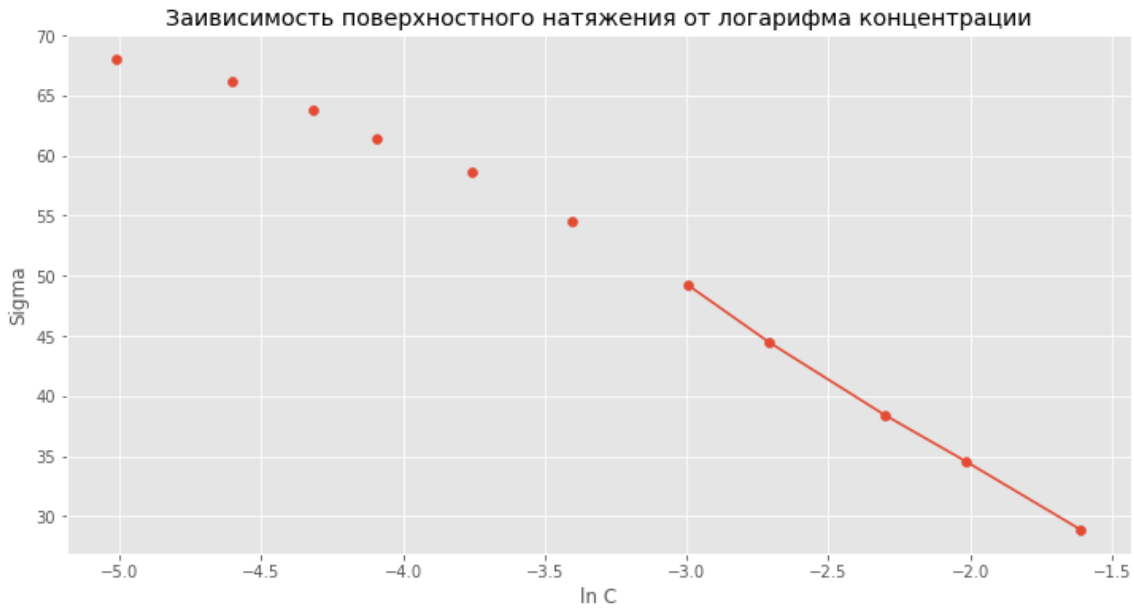
In [32]:

```
plt.figure(figsize=(12, 6))
plt.style.use("ggplot")
tmp = df[df.index < 12]
plt.scatter(np.log(tmp["C"]), tmp["sigma"])


tmp = df[(df.index < 12) & (df.index > 6)]
plt.plot(np.log(tmp["C"]), tmp["sigma"])
plt.title("Заивисимость поверхностного натяжения от логарифма концентрации")
plt.xlabel("ln C")
plt.ylabel("Sigma")
slope, intercept, r_value, p_value, std_err = linregress(np.log(tmp["C"]), tmp[
"sigma"])
slope, intercept, r_value, p_value, std_err
```

Out[32]:

```
(-14.589271886782937,
 5.175333047657645,
 -0.9993560176529759,
 1.9615656380635667e-05,
 0.30243692027339886)
```



In [11]:

```
C1 = intercept
b = -slope
C1, b
```

Out[11]:

```
(5.175333047657645, 14.589271886782937)
```

In [12]:

```
sigma0 = 72.75
```

In [13]:

```
A = np.exp((sigma0 - C1) / b)
A
```

Out[13]:

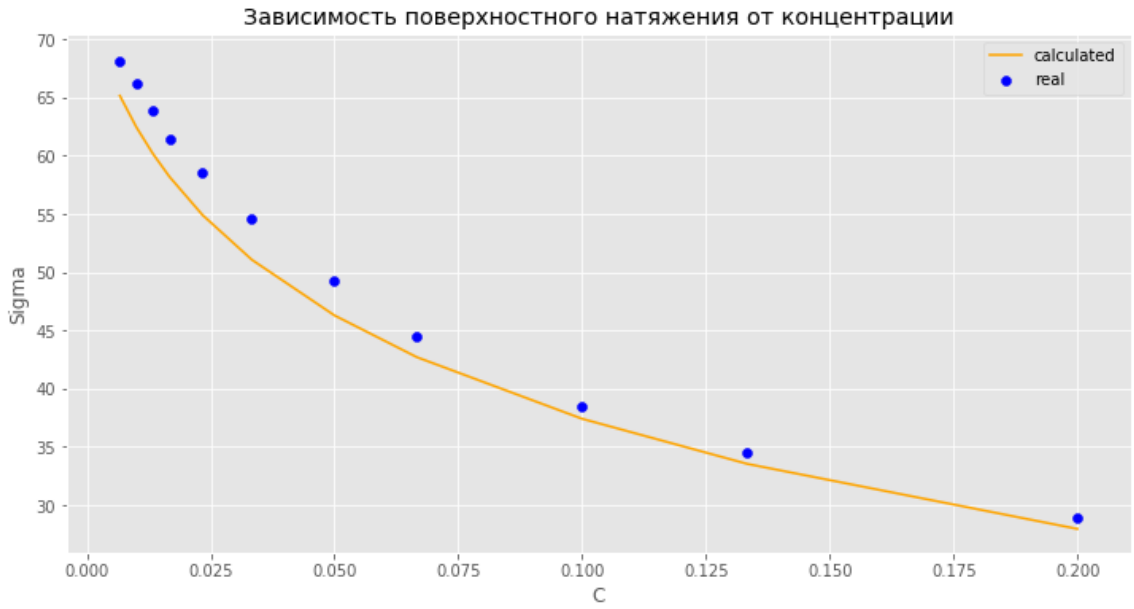
```
102.69930063530747
```

In [25]:

```
plt.figure(figsize=(12, 6))
df["sigmaR"] = sigma0 -b*np.log(1 + A * df["C"])
tmp = df[df.index < 12]
plt.plot(tmp["C"], tmp["sigmaR"], color="orange", label="calculated")
plt.scatter(tmp["C"], tmp["sigma"], color="blue", label="real")
plt.xlabel("C")
plt.ylabel("Sigma")
plt.title("Зависимость поверхностного натяжения от концентрации")
plt.legend()
```

Out[25]:

```
<matplotlib.legend.Legend at 0x7f3ccad6bf28>
```

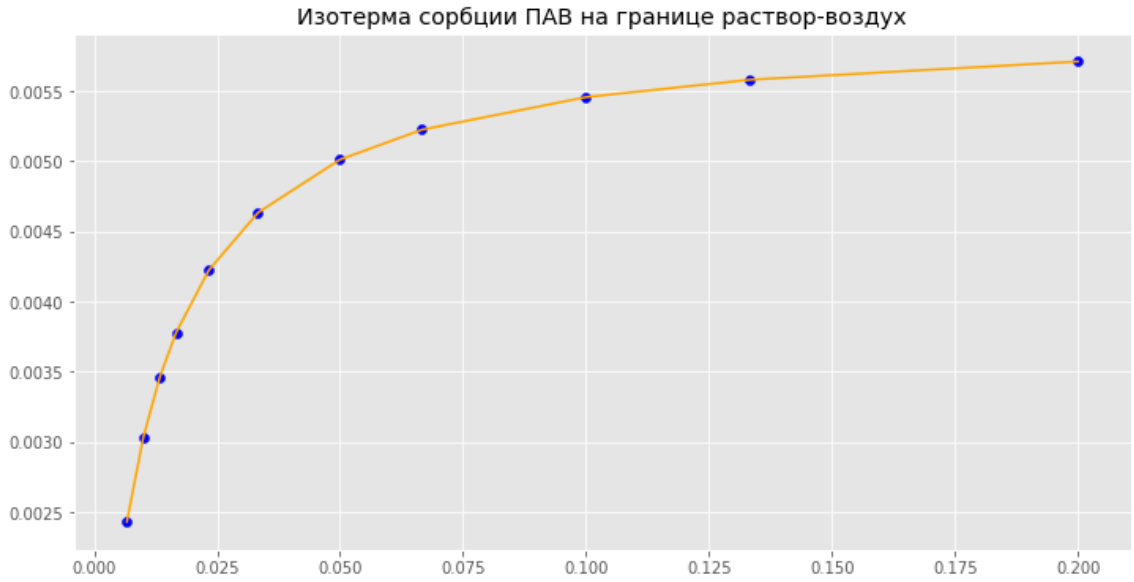


In [29]:

```
R = 8.314
T = 293.15
plt.figure(figsize=(12, 6))
df["Г"] = b / (R * T) * A * df["C"] / (1 + A * df["C"])
tmp = df[df.index < 12]
plt.title("Изотерма сорбции ПАВ на границе раствор-воздух")
plt.plot(tmp["C"], tmp["Г"], color="orange")
plt.scatter(tmp["C"], tmp["Г"], color="blue")
```

Out[29]:

```
<matplotlib.collections.PathCollection at 0x7f3cca9c3550>
```

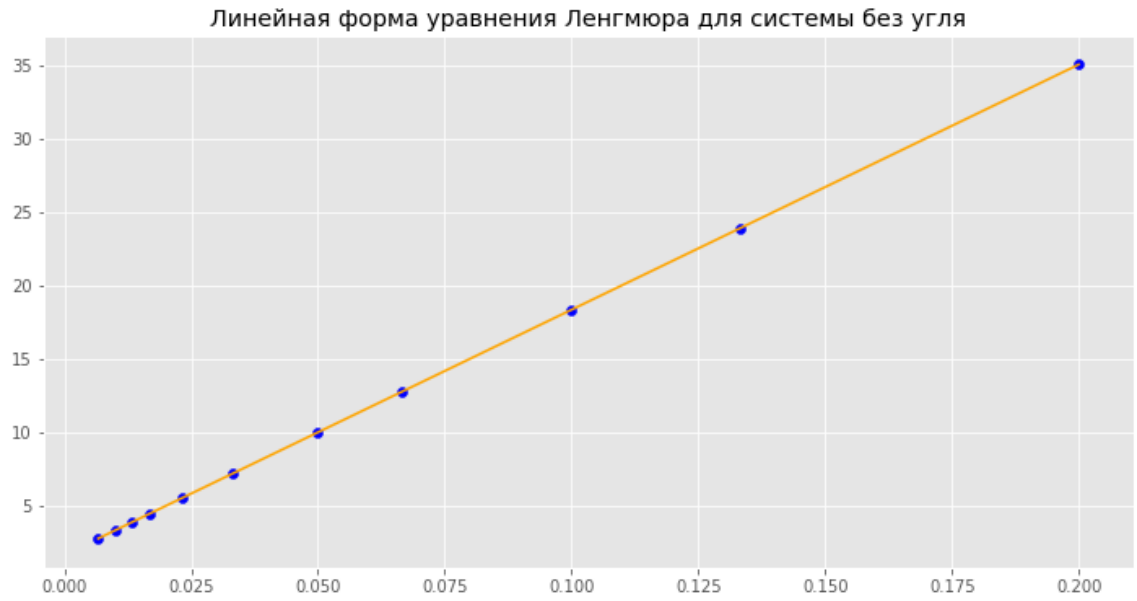


In [35]:

```
plt.figure(figsize=(12, 6))
plt.title("Линейная форма уравнения Ленгмюра для системы без угля")
tmp = df[df.index < 12]
plt.plot(tmp["C"], tmp["C"]/tmp["Г"], color="orange")
plt.scatter(tmp["C"], tmp["C"]/tmp["Г"], color="blue")
slope, intercept, r_value, p_value, std_err = linregress(tmp["C"], tmp["C"]/tmp[
"Г"])
slope, intercept, r_value, p_value, std_err
```

Out[35]:

```
(167.05762418534482, 1.626667593176494, 1.0, 5.8534851285390365e-90,
0.0)
```



In [36]:

```
Гm = 1/slope
Гm
```

Out[36]:

```
0.0059859584671845545
```

In [37]:

```
s0 = 1 / (Гm * 6.02e23)
s0
```

Out[37]:

```
2.7750435911186844e-22
```

In [38]:

```
delta0 = Гm * (12*5+11+17) / 1000 / 814
delta0
```

Out[38]:

```
6.471306451010328e-07
```

In [ ]:

```
```

In [43]:

```
def sigma(C):
    return sigma0 -b*np.log(1 + A * C)
```

In [44]:

```
def C(sigma):
    return (np.exp((sigma0 - sigma)/b) - 1) / A
```

In [ ]:

```
```

In [58]:

```
df["C*"] = C(df["sigma"])
df["Γ*"] = (df["C"] - df["C*"]) * 30 / 1e6 / 1e-3
```

In [ ]:

```
```